Environment Canada Environnement Canada

A Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act*

May 2010

Canada

EcoLogo

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Preface – The *Kyoto Protocol Implementation Act*

This document constitutes the Climate Change Plan for 2010 that the Government is required to publish under Section 5 of the *Kyoto Protocol Implementation Act* (KPIA). The KPIA received Royal Assent on June 22, 2007. This is the fourth iteration of the Plan required under the Act, the previous having been released on June 2, 2009.

Legal Requirements

As per the KPIA, this Plan fulfills the following legal requirements:

Section 5 of the *Act* provides that "Within 60 days after this *Act* comes into force and not later than May 31 of every year thereafter until 2013, the Minister [of the Environment] shall prepare a Climate Change Plan that includes:

(a) a description of the measures to be taken to ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, including measures respecting:
  i) regulated emission limits and performance standards,
  ii) market-based mechanisms such as emissions trading or offsets,
  iii) spending or fiscal measures or incentives,
  iii.1) a just transition for workers affected by greenhouse gas emission reductions, and
  iv) cooperative measures or agreements with provinces, territories or other governments.

(b) for each measure referred to in paragraph (a),
  i) the date on which it will come into effect, and
  ii) the amount of greenhouse gas emission reductions that have resulted or are expected to result for each year up to and including 2012, compared to the levels in the most recently available emission inventory for Canada;

(c) the projected greenhouse gas emission levels in Canada for each year from 2008 to 2012, taking into account the measures referred to in paragraph (a), and a comparison of those levels with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol;

(d) an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions"

In addition, paragraphs (e) and (f) of section 5 (1) stipulate that the Government must publish:

"(e) a report describing the implementation of the Climate Change Plan for the previous calendar year; and

(f) a statement indicating whether each measure proposed in the Climate Change Plan for the previous calendar year has been implemented by the date projected in the Plan and, if not, an explanation of the reason why the measure was not implemented and how that failure has been or will be redressed."

Section 9 also requires that the Minister of the Environment prepare, within 120 days after the *Act* comes into force, a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012 from each regulation and measure.[1]

[1] No similar requirement exists for any of the Plans following the 2007 Plan. To review the Statement, please see the 2007 Climate Change Plan.

Continuous Cycle of Improvement

Section 10 of the *Kyoto Protocol Implementation Act* (KPIA) requires the National Round Table on the Environment and the Economy (NRTEE) to review each annual Climate Change Plan within 60 days after it is published. Additionally, the Commissioner of the Environment and Sustainable Development (CESD) is required to prepare a report on the Plans at least once every two years. At present, the NRTEE has provided reviews of the 2007, 2008 and 2009 Plans and the CESD's first review of the 2007 and 2008 Plans was completed in Spring 2009. Wherever possible and appropriate, the Government has adapted each Climate Change Plan and improved reporting based on a number of their observations and recommendations.

In the first KPIA Plan in 2007, the Government provided individual emissions reductions for each measure as required by the Act. In its first review, the NRTEE recommended that the Government also report on the measures in an integrated fashion to account for any interaction effects between programs that could result in an overstatement of reductions. The Government responded to this recommendation in the 2008 Plan by providing an integrated reporting of measures using a modeling approach, as well as reporting the expected reductions for each measure consistent with the requirements of the Act. In that, and in all subsequent Plans, overall integrated estimates will be different from the aggregate of the individual measures because they account for interaction effects. NRTEE welcomed this methodological change by noting that the 2008 Plan was a "significant improvement" from the 2007 Plan.

The cycle of improvement continued in the 2009 Plan with the inclusion of further refinements as suggested by the CESD. For example, the 2009 Plan provided uncertainty analysis for the reduction numbers for most of the measures, including a range of emissions reductions outcomes. The 2009 Plan also provided greater detail in support of the Government's positions on two of the Act's requirements – provisions for a just transition for workers affected by measures in the Plan, and efforts to ensure an equitable distribution of emission reductions across sectors of the economy. Finally, greater detail was provided on the implementation status of the measures to which emission reductions are attributed during the Kyoto Protocol period.

The 2010 Plan further reflects the Government's commitment to continuously improve its reporting on greenhouse gas (GHG) emission reductions measures. In a 2008 report on managing air emissions, the CESD observed that estimates of greenhouse gas emission reductions attributed to the Clean Air and Climate Change Trust Fund were unreliable and not supported by an adequate amount of analytical rigour. In the development of this most recent Plan, officials from the Government of Canada contacted provincial and territorial colleagues requesting descriptions of measures put in place using Trust Fund resources as well as any estimates of expected emissions reductions on an annual basis from those measures between 2008 and 2012.

A number of provinces and territories provided the requested information. As a result, our understanding of how Trust Fund resources have been utilized has been improved and we have changed how emissions reductions are portrayed in this iteration of the Plan to reflect the input received.

In addition, this Plan reflects, as far as is practicable, a CESD recommendation in its 2009 audit that Environment Canada report on *actual* GHG emissions reductions achieved over the Kyoto period (2008-2012). Each year, in accordance with United Nations Framework Convention on Climate Change (UNFCCC) reporting requirements, the Government of Canada publishes an annual National GHG Inventory. The Inventory process takes two years to complete, making 2010 the first year where actual data for the Kyoto period is available. Accordingly, estimates for actual national emissions in 2008 are given in this Plan and, going forward, future Plans will be similarly updated reflective of the two year reporting lag of National GHG Inventory data.

However, the ability of the Government of Canada to respond to this recommendation is somewhat limited at a program level by the nature of these historical statistics. Providing data on actual reductions achieved on a measure by measure basis can often only be estimated, even on a historical basis, because data on actual emissions is not available at the level of disaggregation required. Nevertheless, recognizing that this information would strengthen the Plan, the Government of Canada responded to the CESD by stating "beginning with the 2010 Plan, when the first results are known for the Kyoto period... the Government of Canada will provide the estimated emissions reductions achieved for the measures in the Plan where it is possible, clearly indicating the methodology used." Reflecting this commitment, Government of Canada Departments have, wherever possible, updated projections with data on actual reductions achieved.

Introduction

The Government of Canada is committed to stopping the increase of Canada's greenhouse gas (GHG) emissions and reducing them.

Throughout 2009, the major area of focus in global efforts to address climate change was preparing for and concluding the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) which took place between December 7 and 19, 2009. The Copenhagen Accord was the main outcome of these negotiations, and Canada was an active and constructive player in leading most Parties to the UNFCCC to accept the Accord, and the Conference of the Parties to take note of it.

Since its inception, 118 countries, representing over 83% of global emissions, have officially associated themselves with the Copenhagen Accord. All major developed countries and 77 developing countries (including all the major emerging economies) have listed nationally-determined mitigation targets or actions in the Appendices to the Accord. On January 29, 2010, Canada inscribed in the Copenhagen Accord its 2020 economy-wide target of a 17% reduction of GHG emissions from 2005 levels.

By finding common ground and including commitments from all major emitters, the Accord represents a significant breakthrough in the global effort to address climate change. It is an important basis for the elaboration of a new, ambitious and binding international climate change agreement and represents a significant step forward in the global effort to reduce emissions and limit increases in global temperature to below 2 degrees Celsius as compared to pre-industrial levels. To build on this accomplishment, Canada will continue to fully support the Copenhagen Accord, and will work with the United States and other like-minded countries to implement the Accord as a package of commitments and to complete negotiations under the UNFCCC to reach a legally binding international treaty that is fair, effective and comprehensive. More detail on these endeavours can be found in Annex 1 of this report.

At the same time, the Government of Canada is also pursuing action at the domestic and continental levels. Taken together, these actions will position Canada as a global leader in the development of clean technologies and clean energy alternatives.

Domestically, since 2006, a range of instruments have been deployed to combat climate change: significant investments have been made in renewable energy, incentives have been put in place to accelerate the development and deployment of green technologies and practices, regulations are being enacted to reduce emissions from key sources, and joint initiatives and investments have been undertaken with provinces and territories to assist them in addressing their unique challenges and facilitate coordinated approaches.

The Government of Canada is working towards meeting its greenhouse gas reduction goals through concrete actions targeting all sources of emissions, including the industrial, electricity generation, transportation, and commercial and residential building sectors. Details on announced measures implemented to date towards these goals can be found in the *Actions to Address Climate Change* section of this Plan.

Further, an orderly transformation of our capital energy stock to less carbon-intensive alternatives, such as natural gas and non-emitting sources such as nuclear, hydro, wind, solar, geothermal, and other renewables, is a key objective. As such, Canada is making a broad range of investments in green energy research and deployment. For example, through the Clean Energy Fund, the Government of Canada is pursuing clean energy research and demonstration projects which, along with the efforts of Canada's provinces and territories, will help enhance Canada's ability to make more environmentally sound use of this country's vast energy reserves. Investments made under the Fund,

targeting large and small demonstration projects, are also benefiting Canada's economy by leveraging $3.6 billion in further investments by industry and other levels of government.

These investments will play an important role in addressing the challenge of climate change and, combined with future efforts and investments, will position Canada as a clean-energy superpower. Nevertheless, the scope of the challenge cannot be overstated. Canada cannot halt or reverse climate change by itself. As a result, all of Canada's actions to confront climate change must be undertaken in a manner aligned with the efforts of others.

In recognition of this reality, the Government of Canada has and will continue to work closely with the United States. Coordinated action is vital due to the high degree of economic integration between our two countries. The United States is Canada's most significant trading partner and largest market. As a result, Canada's framework to address climate change must allow for alignment with that of the United States to preserve the competitiveness of Canadian firms, minimize inefficiency resulting from policy differences and to mitigate the risk of possible border measures resulting from GHG regulations in the United States. Without such coordination, the economic interaction between both countries may become inefficient, causing unnecessary economic hardship and weaken Canada's ability to make the investments in our country's capital stock that will be necessary for sustained emission reductions and continued economic success.

The launching of the Clean Energy Dialogue with the United States was an important step forward in coordinating our efforts. It focuses on three critical areas: expanding clean energy research and development; developing and deploying clean energy technology; and building a more efficient electricity grid based on clean and renewable generation.

Through the Dialogue process, a roundtable held in Washington in June, 2009 involving a broad range of stakeholders and both federal governments launched work on an action plan with twenty joint projects. A Report to Leaders detailing progress on these projects for Canadian Prime Minister Stephen Harper and United States President Barack Obama was then presented in September, 2009, and work is now continuing towards the next Report expected in Spring 2010.

The 2010 North American Leaders Summit provides an additional forum in which Canada works closely with both the United States and Mexico to advance climate change goals on a regional basis and elaborate a common North American approach on issues under discussion in negotiations.

Canada has already taken significant action on the challenge of climate change and is ready to do more in partnership with our largest trading partner and closest ally. Under the Copenhagen Accord, Canada has aligned its target for GHG emission reductions with that of the United States. The Government of Canada is also working with the United States government to coordinate our actions to reduce emissions. The Government of Canada is prepared to adopt a cap-and-trade regime if the United States signals that they are prepared to do the same.

As future Canadian cap-and-trade regulations would be aligned with the system put in place by the United States, they would likely differ from the industrial regulations originally proposed under *Turning the Corner*, which was described in previous Plans. Nevertheless, the foundation set by current Government actions and investments will start to deliver results now on key sources of emissions and position Canada to move with the United States in the future on a broader harmonized approach.

An early example of this strategy is the release of new proposed regulations announced on April 1, 2010 for automobile and light truck GHG emissions over the 2011 to 2016 model years. The intent to develop these GHG emission regulations was first announced in Spring 2009 and proposed regulations were published in April 2010 and reflect our preparedness for future coordinated efforts with the United States. Consistent with the national GHG and fuel economy standards announced by the United States, these regulations will foster significant technological improvements in vehicles to reduce GHG emissions in a manner which minimizes the regulatory compliance burden on Canadian industry.

These regulations will reduce GHG emissions in both the immediate and long term, with accumulated effects extending beyond the period measured in the report. For example, in the near term, it is projected that the average GHG emission performance of new vehicles in the 2016 model year will be about 25% lower than vehicles sold in Canada in 2008. These improvements are expected to result in a cumulative GHG reduction of 92 megatonnes over the lifetime of the 2011-2016 model year vehicles sold in Canada.

On May 21, 2010, the Canadian and American governments announced their intention to work with the heavy-duty trucking industry to develop regulations to reduce GHG emissions from heavy-duty vehicles. Within a broader multilateral framework, the Government of Canada is also pursuing regulations for the marine and aviation sectors. These efforts will reduce emissions and create stable business conditions which will stimulate innovation

Within the context of this multifaceted approach, this Plan outlines the domestic actions that the Government of Canada is taking to reduce the country's greenhouse gas emissions. These actions will be supplemented with additional efforts that will be introduced in the coming years and will be coupled with progress in working continentally and internationally to respond to the challenge of climate change and capitalize on the opportunities of a clean energy future.

Canada's Kyoto Protocol Targets and Obligations

Canada has a long history of leadership in international processes to reduce air pollution and greenhouse gases (GHGs). This section provides a brief historical overview of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, as well as Canada's binding commitments as signatory to the Protocol.

Canada's Commitments under the UNFCCC and the Kyoto Protocol

The **UNFCCC** serves as the focal point through which national governments are cooperatively addressing climate change. The ultimate objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level low enough to prevent dangerous human interference with the climate system. A total of 194 countries have ratified the Convention, which entered into force in 1994.

The Convention lays out a number of requirements for all Parties, including the publishing of national inventories of anthropogenic emissions, promotion and cooperation of the development, deployment and transfer of technologies, and cooperation on climate change adaptation. The UNFCCC also identifies actions that must be undertaken by developed countries, such as development of national policies and corresponding measures to mitigate climate change, provision of information outlining the progress toward their emission reduction goals, as well as provision of new and additional financial resources to assist developing countries in meeting their commitments.

The **Kyoto Protocol** to the UNFCCC, which entered into force in 2005, commits developed countries listed in Annex B of the Protocol to individual targets to limit or reduce their greenhouse gas emissions. Under the terms of the Kyoto Protocol, 38 industrialized countries, including Canada, individually undertook a legally-binding commitment to reduce their respective emissions of a basket of six GHGs (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons) during 2008-2012, with the goal of cutting their collective emissions of greenhouse gases by 5.2% from the 1990 level. Canada's target is an average of 6% below 1990 levels over the 2008-2012 period.

Canada has met, and will continue to meet, a series of requirements under the Kyoto Protocol. These include: submitting periodic "national communications" that include additional information to the information submitted to the UNFCCC; submission of various reports (including the "Initial Report under the Kyoto Protocol" and "Report on Demonstrable Progress under the Kyoto Protocol"); and payment of various fees including those in support of the International Transaction Log that manages transactions between National Registries of greenhouse gases.

Under the UNFCCC, Canada has also associated itself with the **Copenhagen Accord**. In accordance with this commitment, Canada has submitted an economy-wide emissions target of 17% below 2005 levels by 2020. Canada will also provide funding to help developing economies reduce their emissions and adapt to climate change, as part of a collective developed country commitment under the Copenhagen Accord to provide up to US $30 billion for the 2010-2012 period.

Since its inception, 118 countries have officially associated themselves with the Copenhagen Accord and, like Canada, major developed countries support the Accord as the basis for advancing the negotiations towards a new legally-binding regime for the post-2012 period. Working with the United States and other like-minded countries to build support for the Accord and to advance its full implementation as a package of commitments will be the focus of Canada's international engagement on climate change in 2010.

Although the UNFCCC entered into force in 1994, it is only in recent years that programs and policies have been put in place to begin to reduce Canada's emissions, and their benefits will not be fully felt during the Kyoto period. That is why Canadian action on climate change is focused on the future, specifically on meeting the goal of a 17% reduction in greenhouse gas emissions from 2005 levels by 2020, as articulated by our commitments under the Copenhagen Accord.

Timelines for Compliance with the Kyoto Protocol

The first commitment period of the Kyoto Protocol began January 1, 2008, and ends December 31, 2012. Kyoto Protocol Annex B Parties are required to submit their annual greenhouse gas emissions data in the form of a national inventory report, with the final report for 2012 due on April 15, 2014. The degree to which a signatory Party has met its emissions reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014.

An Expert Review Team will examine and record each country's total GHG emissions and carbon sink removals for the commitment period (2008-2012). Once the Expert Review process has been completed for all Parties, a 100-day "additional period for fulfillment of commitments" will begin. This period is intended to provide Parties with the opportunity to undertake and finalize the transactions necessary to achieve compliance with Article 3, paragraph 1, of the Kyoto Protocol. The specific date when the 100-day period begins will be determined by the Conference of the Parties to the Kyoto Protocol prior to 2014.

Actions to Address Climate Change

The Government's domestic climate change agenda will continue to evolve over time. This Plan includes those programs and policies announced and funded as of May 1, 2010. While the Plan provides contextual information on new climate change measures, emissions reductions estimates are only provided for those measures that are expected to result in emissions reductions during the Kyoto period (e.g. ecoEnergy for Renewable Power is now in place and is expected to result in 20.65 megatonnes [Mt] of reductions of greenhouse gas [GHG] emissions between 2008 and 2012), as per the requirements of the *Kyoto Protocol Implementation Act*.

Pursuant to the requirements of paragraph 5 (1) (a) (iii.1) of the *Act* regarding measures respecting a just transition for workers affected by greenhouse gas emission reductions, the Government has considered the requirement and determined that the implementation of regulatory or other measures in this Plan will not require significant worker adjustment in regulated industries.

Similarly, paragraph 5 (1) (d) of the *Act* requires the Government to ensure "an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions". The analysis conducted by the Government indicates that there will not be any notable inequities among sectors.

In response to the Commissioner of the Environment and Sustainable Development (CESD) audit, additional details pertaining to the projected employment levels and greenhouse gas emission reduction levels among economic sectors are identified in Annex 3.

Regulating Energy Efficiency — Strengthening Energy Efficiency Standards

As indicated in previous Plans, the Government of Canada is in the process of amending energy efficiency regulations under the *Energy Efficiency Act*. This measure, initiated April 1, 2007, is being implemented as planned and continues from last year.

Amendments to the *Energy Efficiency Act* in September 2009 allow for energy efficiency standards to be set for products that affect energy consumption, including windows and doors, as well as thermostats and other energy-system control devices. The amended Act also allows for the development of future standards to reduce the amount of energy consumed by televisions, microwaves, CD players and computers, even when they are turned off.

Since 2008, seven new product standards and four improved standards have been implemented. Drafting is progressing on six new standards and eight revised standards to be pre-published in the second quarter of 2010/11.

ENERGY STAR labelling complements the standards by leading consumers to the best performing equipment. In fiscal year 2009/10, ENERGY STAR criteria were developed for two new products, and sixteen existing criteria were revised. Sixty-two companies joined the ENERGY STAR initiative for a total of just over 1,100 participants.

The expected reduction of GHG emissions for 2008 indicated in the 2009 KPIA report was 0.09 Mt. There is no difference between expected and actual estimates.

Actual Reductions (Mt) for 2008	0.09[2]			
Projected Reductions (Mt) for:[3]	**2009**	**2010**	**2011**	**2012**
Expected	0.23	0.61	1.08	2.99

Regulating Transportation

Reducing Greenhouse Gas Emissions from New Cars and Light Trucks

The Government has published draft regulations to establish mandatory emissions standards for new passenger cars and light duty trucks sold in Canada following the expiry of a voluntary Memorandum of Understanding between the Canadian automotive industry and the Government. The regulations will be developed under the *Canadian Environmental Protection Act, 1999* (CEPA, 1999) and will be aligned with the approach taken in the United States in order to reduce GHG emissions in a manner which minimizes the regulatory compliance burden on Canadian industry. The regulations will take effect beginning with the 2011 model year.

A Notice of Intent to regulate under CEPA was published in the Canada Gazette Part I in April 2009. A consultation draft of the proposed regulations was released publicly in December 2009. The proposed regulation was published in the Canada Gazette Part I in April 2010 for a 60-day formal public comment period.

The proposed regulations apply to manufacturers and importers of new passenger automobiles and light trucks sold in Canada. The proposed regulations include mandatory fleet average GHG emission standards (expressed in units of grams of CO_2 equivalent emissions per distance driven) and a company's "unique" fleet average standards would be determined based on the size (i.e. footprint) and the number of vehicles it sells in a given model year. The proposed regulations include separate standards for fleets of passenger automobiles and light trucks, progressively increasing in stringency through the 2011-2016 model years.

Manufacturers are expected to meet the fleet average GHG emission standards primarily by introducing improved GHG-reducing technologies to new vehicles or may also pursue other changes, such as shifts in the sales mix among vehicle models and between cars and light trucks. The proposed regulations include a system of emission credits to help meet overall environmental objectives in a manner that provides the regulated industry with additional compliance flexibility.

Expected reductions are outlined below. Over the lifetime operation of all 2011 to 2016 model year vehicles sold in Canada, the Government of Canada anticipates that the proposed regulations will result in a cumulative reduction of some 19 Mt of CO_2 emissions from the business-as-usual scenario.[4]

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[2] Results are based on projected reductions outlined in the Regulatory Impact Analysis Statement (RIAS, December 24, 2008) and estimated reductions attributable to complementary ENERGY STAR and EnerGuide labelling programs.

[3] Note that the projected reductions have been modified from past KPIA input as a result of changes to regulatory timing and scope. As they are based on technical product and market data, the projected reductions are not presented as a range in the RIAS and therefore, shown in a similar fashion above. For more information on these energy efficiency regulations, consult the amendments via the link below.
www.gazette.gc.ca/rp-pr/p2/2008/2008-12-24/html/sor-dors323-eng.html

[4] Reductions will start in 2010, as typically some 40% of a model year is sold in the previous calendar year, with the remaining 60% being sold in the model year calendar year.

Actual Reductions (Mt) for 2008	NA			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Expected	NA	0.2	0.8	1.5

Reducing Emissions from Rail, Air and Marine Transportation

Rail

In May 2007, Environment Canada, Transport Canada, and the Railway Association of Canada (RAC) signed a Memorandum of Understanding that set GHG emission intensity targets for the various rail services such as freight and passenger rail. The U.S. has not yet published regulations for greenhouse gas emissions from railways. GHG emission regulations for the Canadian rail sector will be developed in collaboration with the U.S. Environmental Protection Agency. Once the draft regulations are finalized, estimates of their impacts will be reported.

Air

The government is working through the International Civil Aviation Organisation (ICAO) to limit or reduce aviation emissions. ICAO is developing a CO_2 emissions standard for new carrier types expected to be ready by 2013. The discussion of a global approach to GHG emissions management for international aviation, including targets, the use of market based measures and assistance to developing countries, is ongoing. It is too early to assess how this global dialogue will translate into domestic policies and measures. Voluntary commitments with Canadian carriers to achieve fuel efficiency targets are in place and discussions are ongoing to expand them. Once regulations on CO_2 emissions are finalized, estimates of their impacts will be reported.

Marine

Canada is working with other countries at the International Maritime Organization (IMO) to address the impacts of the international shipping sector on climate change. Interim technical measures to assess ship efficiency are being developed and discussions on market measures are expected in 2010. The Government of Canada supports the development of a global approach to address greenhouse gas emissions from the marine sector that would apply to ships of all flags. Once adopted by the IMO, these international standards would be considered in the development of domestic regulations under the *Canada Shipping Act, 2001*. As work on these standards is still in progress, the government is not in a position to provide expected emission reductions at this time. Developments are ongoing. Once the draft regulations are finalized, estimates of their impacts will be reported.

Regulating Renewable Fuels Content

Regulations under development by Environment Canada would require 5% renewable content based on the gasoline pool by 2010. This measure is expected to come into effect in September 2010. A 2% renewable content in diesel and heating oil is intended to come into effect by 2011 or earlier, subject to an assessment of technical feasibility.

The proposed Federal *Renewable Fuels Regulations* were published in the Canada Gazette, Part I on April 10, 2010 for a 60-day formal public comment period. The draft regulations set out the full regulatory approach and are an integrated package with a place-holder for the coming into force date of the 2% requirement.

Consultations were held with stakeholders in 2009 to develop the proposed Regulations. The Government of Canada will continue to work in close consultation with provinces and territories, renewable fuels and petroleum industries and other key stakeholders as we finalize the regulations and consultation sessions are being held in spring of this year.

Bill C-33, *An Act to Amend the Canadian Environment Protection Act, 1999*, provided additional authorities needed to make efficient national regulations requiring renewable content in Canadian fuels. It received Royal Assent on June 26, 2008, and came into force in September 28, 2009.

Projected reductions are below.

Actual Reductions (Mt) for 2008	**NA**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	NA	0.19	1.98	2.01
High	NA	2.52	4.02	4.08
Expected	NA	0.19	1.98	2.01

Supporting Renewable Fuels Development

The Government of Canada is supplementing these regulations with a number of program measures that make up the Government's full renewable fuels agenda. While the initiatives described below will not achieve direct reductions during the Kyoto period, they will help promote future renewable fuel technologies that are necessary to combating climate change over the long term.

The **ecoENERGY for Biofuels Initiative** supports the production of renewable alternatives to gasoline and diesel and encourages the development of a competitive domestic industry for renewable fuels. ecoENERGY for Biofuels will invest up to $1.5 billion over nine years in support of biofuels production in Canada. Administered by Natural Resources Canada, the program runs from April 1, 2008 to March 31, 2017. The ecoENERGY for Biofuels Initiative is part of the Government of Canada's renewable fuels strategy. The program plays a key role in helping industry get renewable fuels on the market in advance of the renewable fuels regulation.

At present, the program is in its third year of operation and is fully operational. As of April 1, 2010, the Government has 21 signed Contribution Agreements under the program, representing a total commitment of $966 million ($765 million Ethanol and $201 million biodiesel) with a potential production of 1.6 billion litres attainable by 2011/12. Deadline for applications was March 31, 2010.

The **ecoAGRICULTURE Biofuels Capital Initiative** (ecoABC), a $200 million initiative in operation since 2007, provides repayable contributions of up to $25 million per project to help the biofuels industry overcome the challenges of raising the capital necessary for the construction or expansion of biofuels facilities. In 2006, the Government also announced the Agricultural Bioproducts Innovation Program. Further, in 2006, a component was added to the Co-operative Development Initiative to focus on biofuels and value added activities for agricultural production.

In 2006, the Government also announced the **Biofuels Opportunities for Producers Initiative**, which assisted agricultural producers in developing sound business proposals and in undertaking feasibility or other studies to expand biofuels production capacity. The initiative ended March 2008. Over the duration of the program, 121 projects were supported for a total of $18.2 million.

In 2007, an additional $500 million was announced for use by Sustainable Development Technology Canada to invest with the private sector in establishing large-scale facilities for the production of next-generation renewable fuels.

Budget 2008 also made investments in the development of renewable fuels in Canada. The Government provided $10 million over two years for scientific research and analysis on biofuels emissions to support regulations development and demonstration projects to verify that renewable diesel fuel is safe and effective for the Canadian climate. Budget 2008 also provided funding to establish a pilot program to demonstrate E85 fuelling infrastructure and promote its commercialization. E85 is a renewable fuel containing 85% ethanol and 15% gasoline.

Finally, and most recently, in June 2009 the Government of Canada announced the **Pulp and Paper Green Transformation Program (PPGTP),** which is intended to improve the environmental performance of pulp and paper mills in Canada. Eligible firms were allocated credits based on their production of a biofuel, black liquor, at a rate of $0.16/litre. The credits were awarded retroactively for black liquor produced since January 2009. The program cap of $1.0 billion was reached in May 2009, with 24 companies representing 38 mills across Canada receiving credit allocations. These credits may be used to finance approved capital projects with environmental benefits, such as investments in energy efficiency or the production of renewable energy from forest biomass. Credits earned at one pulp and paper facility may be spent on eligible projects at any Canadian pulp and paper mill(s) owned by the same company. Expected outcomes of the program include:

- Improved energy efficiency at Canadian pulp and paper mills;
- Increased production of renewable energy at Canadian pulp and paper mills;
- Improved environmental performance at Canadian pulp and paper mills; and
- Investments in innovation and technology which contribute to an environmentally and commercially sustainable pulp and paper industry in Canada.

This measure is being implemented on the expected timeline. However, project approvals are just beginning. Once more projects are approved, the impact on GHG emissions will be estimated.

ecoACTION Investments

As a means to support regulatory actions and further reduce GHG emissions, the Government is investing in a series of ecoACTION programs intended to promote the development and deployment of new technologies. This section outlines ecoACTION initiatives including ecoENERGY and ecoTRANSPORT. The emissions reduction ranges provided for each of these measures are based on the variability in factors relating to program implementation. Generally, the Government reports the lowest or average figure in the range to provide the most conservative estimate of program impacts. The methodology used to calculate the emissions reduction ranges attributed to each ecoACTION investment is referenced in Annex 2. In addition, Annex 2 provides uncertainty analysis in relation to the methodology in response to recommendations made by the CESD.

The following sections detailing ecoACTION investments address the requirements of paragraph 5(1)(a)(iii) of the *Kyoto Protocol Implementation Act* as well as paragraphs 5 (1)(b)(i) and (ii), (e) and (f).

ecoENERGY Initiatives

ecoENERGY Technology Initiative

The ecoENERGY Technology Initiative (ecoETI) is investing $230 million over 5 years (2007-12) in the research, development and demonstration of clean transformational energy technologies and systems. The Initiative is directed towards increasing clean energy supplies, reducing energy waste and reducing pollution from conventional energy.

The program came into effect in January 2007 and the first funding announcement was in October 2007 for the clean coal technology project. The Initiative is in its third year of operation and has fully allocated its funding to approved projects and initiatives. (Note: A one-year extension was approved for the original four-year profile. Therefore, ecoETI will terminate in March 2012).

Seven projects for the development and pre-demonstration of carbon capture and storage technologies are underway. In addition, ten projects to demonstrate hydrogen and fuel cell systems and about 90 Research and Development projects in eight areas (Clean Coal and CCS, Next Generation Nuclear Systems [Gen IV], Built Environment, Distributed Power Generation, Energy Efficient Industrial Processes, Clean transportation, Oil Sands, and Bioenergy) have been funded.

The new technologies are expected to lead to significantly reduced emissions of particulates, gaseous pollutants, toxic substances and greenhouse gases from the production and use of energy. Given the long-term nature of research and development and the many factors that come into play for the adoption of leading edge technologies, firm quantitative estimates of air pollutant and GHG emission reductions are not possible.

ecoENERGY for Renewable Power

The ecoENERGY for Renewable Power program is investing $1.48 billion to provide incentives to increase Canada's supply of clean electricity from renewable sources such as wind, biomass, low-impact hydro, geothermal, solar photovoltaic and ocean energy. The program will provide an incentive of 1 cent/kWh for up to 10 years to qualifying projects.

The program came into effect on April 1, 2007 as projected, and as of March 31, 2010, ninety-nine contribution agreements had been signed with proponents, representing about $1.4 billion in federal funding over 10 years and 4357 MW of renewable power capacity. As of April 1, 2010, fifty-two renewable power projects were in operation representing over 2500 MW of capacity and $803 million in funding commitment over 10 years.

The table below indicates the reductions that the Government anticipates the program will achieve. Projected GHG emission reductions for 2008 were expected to be between 1.7 Mt and 2.2 Mt. The actual GHG reductions fall below this range because there was less renewable electricity produced than expected due to:

- Projects being commissioned later in the year than originally anticipated, resulting in less overall production for the year;
- More wind projects and fewer hydro and biomass projects commissioned than anticipated in 2008 – wind production has a lower capacity factor than hydro or biomass; and
- The experience of the program is that projects produce approximately 7% less electricity than what is expected by proponents at the time of signature of Contribution Agreements.

Actual Reductions (Mt) for 2008	1.35			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	2.5	4.5	5.7	5.7
High	2.9	5.0	6.7	6.7
Expected	2.6	4.7	6.0	6.0

ecoENERGY for Renewable Heat

The ecoENERGY for Renewable Heat initiative is investing approximately $36 million over 4 years in incentives and industry development to support the adoption of clean renewable thermal technologies such as solar air and solar hot water for water and space heating in buildings. The program achieves GHG reductions by encouraging individuals and organizations to use renewable solar thermal systems.

This measure has been fully implemented as planned and continues from last year. Since the program's inception on April 1, 2007, and as of March 31, 2010, a total of 1141 funding applications from industrial, commercial and institutional sectors to install solar air and solar hot-water systems have been received, and Contribution Agreements have been signed with successful applicants for 773 projects, representing about $16 million in federal funding. These agreements represent 910 systems, well above the program target of 700 systems. In addition, Contribution Agreements with partners (utilities, developers and buyers' groups) are in place for 14 pilot projects to test ways to deploy solar hot water systems in the residential sector. Under these pilot projects, up to 2000 solar water-heating systems will be installed in Canadian homes by the end of the program. Also under the ecoENERGY for Renewable Heat program, the Government of Canada has entered into Information Sharing Agreements with Ontario, Saskatchewan and British Columbia to coordinate complementary solar thermal programs and has also entered into agreements with two renewable energy industry associations and two other groups to improve training and certification of solar and geoexchange industry professionals.

The expected reduction of GHG emissions indicated in the 2009 KPIA report for 2008 was between 0.003 Mt and 0.005 Mt. There was no difference between expected and actual estimates for 2008.

Actual Reductions (Mt) for 2008	0.003			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.007	0.012	0.02	0.02
High	0.01	0.018	0.03	0.03
Expected	0.008	0.016	0.025	0.025

ecoENERGY for Buildings and Houses

The ecoENERGY for Buildings and Houses program is investing $60 million over 4 years to encourage the construction and operation of more energy-efficient buildings and houses through a range of complementary activities. The ecoENERGY for Buildings and Houses measure came into effect on April 1, 2007. The program has started its fourth year of operation and is fully implemented.

Specific activities include, but are not limited to: implementing new design tools and training programs (e.g., Dollars to $ense workshops, workshops on new building design simulation and RetSCREEN[5]), updating building energy codes, building benchmarking, rating and labelling, promoting labelling systems for housing (e.g., EnerGuide Rating System), engaging in ongoing dialogue and co-operation with provincial and territorial programs, increasing awareness of energy efficiency approaches in buildings, such as building optimization, and establishing and maintaining partnerships to encourage energy efficiency capacity building.

By April 1, 2010, over 4,000 building owners, managers, operators, designers and builders had received energy management training, while almost 400 commercial buildings received energy labels as part of a pilot energy management labelling and benchmarking program.

The expected reduction of GHG emissions indicated in the 2009 KPIA report for 2008 was between 0.32 and 0.36 Mt. Earlier than anticipated energy building code adoption in the provinces of Ontario and British-Columbia explain the greater than expected GHG reductions in 2008 and 2009. In addition, the updated code will be adopted by some provinces in September 2011 or later. This differs from the original targets, reflected in the 2009 KPIA report, which anticipated provinces adopting an updated code before March 2011. The expected GHG reductions for 2011 and 2012 have therefore been lowered somewhat.

Actual Reductions (Mt) for 2008	**0.58**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Expected	0.98	1.26	1.49	1.81

ecoENERGY Retrofit Initiative

The ecoENERGY Retrofit Initiative (total funding of $805 million over 5 years) provides incentives for energy efficiency improvements in homes and in small and medium-sized organizations in the institutional, commercial and industrial sectors. The program is made up of three components:

- ecoENERGY Retrofit – Homes ($745 million over 4 years): Provides home and property owners with grants up to $5,000 per unit to offset the cost of making energy efficiency improvements. The Retrofit – Homes program involves residential energy efficiency assessments by certified energy advisors and is complemented by a suite of provincial programs.
- ecoENERGY Retrofit – Small and Medium Organizations ($40 million over 5 years): Provides financial incentives to facilities meeting specified criteria based on the estimated amount of energy saved by retrofit activities.

[5] RETScreen Clean Energy Project Analysis Software is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software is used to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs).

- ecoENERGY Retrofit – Included $20 million in 2007-08 for the Existing Buildings Initiative which promoted behavioural changes and energy-saving retrofits to improve energy efficient practices through financial incentives, partnerships, and training and advice.

Launched April 1, 2007, the program is in its fourth year of operation and is fully implemented. An additional $285 million was allocated to the ecoENERGY Retrofit for Homes program in response to unprecedented demand, bringing the total budget for this element to $745 million over four years. As of March 2010, over 250,000 homeowners have completed energy efficiency upgrades eligible for grants. These upgrades will reduce their annual energy consumption by about 23% and GHG emissions by approximately 3.1 tonnes per house per year.

On March 31, 2010, the program ceased accepting bookings for pre-retrofit evaluations, but will continue to process grant applications from homeowners who have had these evaluations and remain eligible. This demonstrated prudent program management and will aim to ensure that all eligible homeowners who previously entered the program have the opportunity to apply for a grant. While the pre-retrofit assessment phase is now complete, homeowners will continue to undertake energy efficiency improvement work on their homes, which will increase the energy savings and GHG reductions already achieved by the program.

The ecoENERGY Retrofit for Small and Medium Organizations has started its fourth year of operation and is fully implemented. As of April 1, 2010, 852 contribution agreements have been signed in the Buildings and Industry Sectors. These agreements are for projects worth $161 million in value, yielding annual energy cost savings of $29 million.

The expected reduction of GHG emissions indicated in the 2009 KPIA report for 2008 was between 0.45 and 0.51 Mt. Actual outcomes were lower in 2008 than projected because some components of the program had lower than expected emissions reductions in 2008. However, these results were partially offset by greater than expected results in other components.

Actual Reductions (Mt) for 2008	**0.39**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.65	1.67	1.87	1.87
High	0.74	1.72	2.2	2.2
Expected	0.67	1.72	1.94	1.94

ecoENERGY for Industry

The ecoENERGY for Industry program is investing $18 million over 4 years to encourage information-sharing on new technologies and best practices in energy use, as well as training and specialized assessments for energy managers to identify and implement energy-saving projects.

EcoENERGY for Industry is an industry-government partnership delivered through the Canadian Industry Program for Energy Conservation (CIPEC). CIPEC encourages industrial energy efficiency improvements and reductions in GHG emissions through a number of voluntary activities, including: Dollars to $ense energy management workshops, site-specific industrial energy assessment incentives, and recognition programs for industrial energy-efficiency leaders.

The program took effect April 1, 2007, is in its fourth year of operation, and was fully implemented by the projected date. As of April 1, 2010, a total of 3,100 industrial energy managers have been trained and the CIPEC network has continued to grow.

The expected reduction of GHG emissions indicated in the 2009 KPIA report for 2008 was between 0.17 and 0.74 Mt. As a result, actual results for 2008 are within the expected range.

Actual Reductions (Mt) for 2008	**0.64**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.27	0.37	0.40	0.40
High	1.17	1.59	1.70	1.70
Expected	1.03	1.44	1.54	1.54

ecoENERGY for Aboriginal and Northern Communities

The ecoENERGY for Aboriginal and Northern Communities program is providing $15 million over 4 years to support renewable energy projects, improve energy efficiency, and encourage the adoption of alternative energy sources in Aboriginal and northern communities.

The Program will assist in the development of installed electrical generation in Aboriginal and northern communities. It will equip Aboriginal and northern communities with the knowledge and tools to increase the energy efficiency of community infrastructure, to access renewable energy opportunities, and to implement cost-effective renewable energy projects. The Program promotes environmentally sustainable communities, but also provides the funding to allow Aboriginal and northern communities to be able to access economic development opportunities that will directly benefit their communities.

The measure is fully operational. Since April 1, 2007, when the measure came into effect, a total of 111 funding applications have been received by the Program. It is important to note that the Program does not enter into multi-year funding arrangements with proponents; therefore applicants must reapply on an annual basis.

As of March 31, 2010, a total of 76 projects, within 64 Aboriginal and northern communities, had received $7.3 million in federal funding through the Program. The funded projects include 13 community energy planning projects, 14 energy efficiency projects, and 49 renewable energy projects. Of the funded projects, 10 (6 renewable energy, 4 energy efficiency) have been commissioned to date and it is anticipated that another 13 projects (8 renewable energy, 5 energy efficiency) will be fully commissioned by the Program end date of March 31, 2011.

Interest in the ecoENERGY for Aboriginal and Northern Communities Program continues to build, evidenced through inquiries received from Aboriginal and northern communities, federal programs, provincial and territorial governments, industry and utilities. Since the beginning of the Program, the number of funding applications received has steadily increased from 24 applications in FY2007-08 to 53 applications in FY2009-10. It is anticipated that the Program will again receive in excess of 50 applications during FY2010-11 and it is expected that the Program will be fully subscribed by November 2010.

The table below indicates the amounts that the Government anticipates the program could achieve.

Actual Reductions (Mt) for 2008	NA			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.001	0.009	0.010	0.021
High	0.001	0.038	0.045	0.124
Expected	0.001	0.009	0.010	0.021

ecoTRANSPORT Initiatives

ecoAUTO Rebate Program

The ecoAUTO rebate program, administered by Transport Canada and delivered in partnership with Service Canada, provided a cash incentive to Canadians to buy or lease more fuel-efficient vehicles. Through this initiative, the federal government offered rebates from $1,000 to $2,000 towards the purchase or lease (12 months or more) of new fuel-efficient vehicles for the model years 2006, 2007 and 2008. Only new eligible vehicles purchased or leased between March 20, 2007 and December 31, 2008, and for which a rebate application form was received by March 31, 2009, qualified for the rebate.

Under this measure, vehicles whose combined fuel consumption (55% city, 45% highway) is at or below the program's fuel consumption targets of 6.5 litres per 100 kilometres for cars and 8.3 litres per 100 kilometres for light trucks were eligible for a rebate of up to $2,000. Flex-fuel passenger vehicles, which are capable of operating with either gasoline or a fuel blend of 15% gasoline and 85% ethanol (E85), received a rebate of $1,000 if their E85 combined fuel consumption rating was no more than 13.0 litres per 100 kilometres. The full rebate schedule is as follows:

Range of Combined Fuel Consumption (Litres per 100 kilometres)	Passenger Cars	Light-Duty Trucks	Flex-Fuel Vehicles E85 Combined Fuel Consumption
5.5 or less	$2,000	$2,000	$1,000
5.6 – 6.0	$1,500	$2,000	$1,000
6.1 – 6.5	$1,000	$2,000	$1,000
6.6 – 7.3	$0	$2,000	$1,000
7.4 – 7.8	$0	$1,500	$1,000
7.9 – 8.3	$0	$1,000	$1,000
8.4 – 13.0	$0	$0	$1,000

The measure was in effect from March 20, 2007. The application forms were released and the measure fully implemented as of October 1, 2007. The measure ended on March 31, 2009, which was the last date to submit an application form for eligible vehicles. Overall, the ecoAUTO rebate program received over 182,300 applications and issued over 169,800 rebates totalling $191.2 million. In addition, the toll-free number received over 113,500 inquiries and the program's website recorded 870,000 visits.

The table below indicates the amounts that the Government anticipates the program will achieve. The range of estimates provided for 2008 represents the most up-to-date estimate of the impact of the program, based on available information and analytical capacity at the time of the preparation of the report. A full-fledged evaluation of the performance of the ecoAUTO rebate program is currently under way, the results of which will not be available in time for inclusion in this report.

Actual Reductions (Mt) for 2008	**0.01 to 0.03**[6]			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.01	0.01	0.01	0.01
High	0.03	0.03	0.02	0.02
Expected	0.01	0.01	0.01	0.01

Green Levy

The Green Levy applies to passenger vehicles with a fuel consumption rating of 13 litres or more per 100 kilometres (55% city and 45% highway) and is imposed at rates ranging from $1,000 to $4,000. The Green Levy is payable by the manufacturer or importer of new vehicles delivered after March 19, 2007 and by the importer of used vehicles, if the used vehicle was originally put into service (in any jurisdiction) after March 19, 2007. The Canada Revenue Agency and the Canada Border Services Agency are responsible for the administration of the Green Levy, working with manufacturers and importers of vehicles to facilitate its application.

This program was implemented by the projected date of March 20, 2007. The table below indicates the amounts the Government anticipates the program will achieve. The range of estimates provided for 2008 represents the most up-to-date estimate of the impact of the program, based on available information and analytical capacity at the time of the preparation of the report. More details about the methodology and assumptions used to derive the estimates for each scenario can be found in Annex 2.

[6] Estimates provided for 2008 were developed using the methodology presented in Annex 2. It is important to note that actual greenhouse gas emissions reductions from the ecoAUTO rebate program can only be estimated, as the only data available are the total number of vehicles sold in Canada during the program, as well as the number of ecoAUTO-eligible vehicles that were sold. The incremental impact of the program on those sales can only be estimated, using assumptions about the impact of the program and of other important factors, such as fuel price and general economic conditions on the behaviour of manufacturers and consumers. This, in essence, is what is accomplished through the use of the North American Feebate Model.

Actual Reductions (Mt) for 2008	0.09 to 0.10[7]			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.14	0.17	0.20	0.23
High	0.14	0.19	0.23	0.28
Expected	0.14	0.17	0.20	0.23

ecoENERGY for Personal Vehicles Program

The ecoENERGY for Personal Vehicles Program is investing $21 million over 4 years to provide Canadians with information and decision-making resources to assist them with buying, driving and maintaining their vehicles in a manner which reduces fuel consumption and greenhouse gas emissions. Such resources include, but are not limited to, the Fuel Consumption Guide, a training curriculum for novice drivers and fuel efficient driving campaigns for experienced drivers that focus on idle reduction, tire inflation and improved driving habits.

These program measures were launched April 1, 2007. The program is in its fourth year of operation and is fully implemented. In 2009/10, over 350,000 novice drivers were trained using materials from the Auto$mart fuel efficient driving curriculum. A fuel savings potential ranging from 5% to 25% is possible when drivers adopt fuel efficient driving techniques.

This program also includes management of the Memorandum of Understanding Between the Government of Canada and the Canadian Automotive Industry Respecting Automobile Greenhouse Gas Emissions (MOU). The MOU voluntarily commits the Canadian automotive industry to achieve a 5.3 Mt reduction in greenhouse gas emissions from passenger cars and light duty trucks in 2010. Industry aims to meet the target through the introduction of advanced and highly fuel-efficient technologies (i.e., hybrid electric, diesel vehicles etc.). The MOU was signed on April 5, 2005.

The expected reduction of GHG emissions for 2008 indicated in the 2009 KPIA report was 0.025 Mt. The actual impact was higher than estimated as a result of faster than projected uptake of the program.

Actual Reductions (Mt) for 2008	0.05			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Expected*	0.09	0.09	0.1	0.1

* This estimate does not reflect reductions expected from the MOU with the Canadian Automotive Industry.

[7] Estimates provided for 2008 were developed using the methodology presented in Annex 2. It is important to note that actual greenhouse gas emissions reductions from the Green Levy can only be estimated, as the only data available are the total number of vehicles sold in Canada during the program, as well as the number of vehicles subject to the Green Levy that were sold. The incremental impact of the Levy on those sales can only be estimated, using assumptions about the impact of the program and of other important factors, such as fuel price and general economic conditions on the behaviour of manufacturers and consumers. This, in essence, is what is accomplished through the use of the North American Feebate Model.

ecoMobility

The $10 million ecoMobility program aims to reduce emissions from the urban passenger transportation sector by helping municipalities attract residents to less polluting forms of transportation. It provides financial support to municipalities and regional transportation authorities for 14 transportation demand management (TDM) projects that reduce emissions by shifting personal automobile travel to other modes, reducing the number and length of car trips, and shifting trips to less congested times and routes. The program is also helping build national capacity to implement TDM measures through research, training, professional development and the development of materials/resources. The program ends in March 2012.

The measure came into effect in April 2007. Program activities were initially delayed to accommodate extensive national consultations in the first year of the program; however, activities are now under way as scheduled and the program has been extended to 2012 to allow a full three year project delivery.

National consultations were held in Summer and Fall 2007 on the design and implementation of the program. Provinces, municipalities and non-governmental organizations reacted positively to the program and there is strong support. A request for proposals to initiate innovative TDM projects in municipalities was launched in February 2008. In January 2009, fourteen projects in thirteen communities across Canada were announced for a total cost of $9 million ($3 million in federal contribution).

Complementary, national capacity building initiatives continue to be rolled out, such as the development of TDM measurement guidelines to assist municipalities and transportation authorities to effectively measure the impact of their initiatives, various webinars, and an inventory of school-based TDM programs. The program is also delivered through various forums, such as Transport Canada's Urban Information Network (which received 500,000 visits between 2004 and 2008 and contains over 80 case studies and issue papers developed on sustainable transportation and TDM), guides on sustainable transportation, such as *Improving Travel Options for Small and Rural Communities*, *Bike Sharing* and *Workplace Travel Plans*. Learning Events with over 85 workshops and conference sessions across Canada have been delivered in collaboration with federal departments and sector associations.

More capacity building activities are planned for the upcoming fiscal year, such as community-based social marketing guidelines for TDM practitioners, webinars to share best practices in the field of sustainable transportation and the development of case studies and training resources for practitioners on the TDM measurement guidelines.

The table below indicates the amounts that the Government anticipates the program could achieve. No GHG reductions were expected for 2008 due to the fact that program was in its first year of implementation and that the project funded under the program was not sufficiently advanced to yield actual GHG reductions.

Actual Reductions (Mt) for 2008	**NA**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	NA	0.109	0.110	0.112
High	NA	0.217	0.220	0.223
Expected	NA	0.109	0.110	0.112

National Vehicle Scrappage Program

The National Vehicle Scrappage Program offers incentives to Canadians who own old vehicles (model year 1995 and older) to retire them. Program participants may choose one of the following: a free transit pass, membership in a car-sharing program; a rebate on the purchase of a newer vehicle (model year 2004 and later); or $300 cash. The primary goal of the program is to reduce smog-forming emissions. Secondary goals are to reduce greenhouse gas emissions by promoting sustainable transportation alternatives, and to prevent the release of toxic substances into the environment by ensuring the responsible recycling of vehicles.

Full implementation of the program across all provinces was delayed from July 2008 to January 2009. An interim approach allowed program delivery in 7 provinces until full implementation was completed. The program is being delivered by the national not-for-profit organization Summerhill Impact, formerly known as Clean Air Foundation. Daily participation has tripled since August 2009 when vehicle manufacturers began offering rebates on new vehicles.

Projected GHG reductions are only a co-benefit as the focus of the program is on reducing smog-forming emissions, not greenhouse gas emissions. GHG emissions reductions are the result of individuals retiring their old vehicle and either choosing sustainable forms of transportation, such as public transit or membership in a car-sharing program or replacing their old vehicle with a more fuel-efficient one; and/or driving less.

Actual reported reductions for 2008 are lower than projected. This is because fewer vehicles than expected were retired and the number of participants choosing a replacement vehicle instead of a transit pass or car sharing was higher than projected.

Actual Reductions (Mt) for 2008	**0.001**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.011	0.009	0.004	NA
High	0.011	0.019	0.017	NA
Expected	0.011	0.010	0.006	NA

ecoTechnology for Vehicles Program

Announced in February 2007, ecoTECHNOLOGY for Vehicles (eTV) program is a four-year, $15 million initiative that helps reduce passenger vehicle emissions by encouraging the adoption of advanced vehicle technologies in the Canadian fleet of light-duty vehicles. The program focuses on five technology areas:

- Improvements in engine, power train, light weight materials, components and vehicle design.
- Diesel technologies.
- Battery technologies.
- Plug-in hybrid electric and gasoline-hybrid electric technologies.
- Hydrogen & fuel cell technologies.

The program's test results help inform the development of regulations, codes and standards for the next generation of advanced vehicles, including electric, fuel cell and plug-in electric hybrid vehicles, among others. Results also help Canadians to better understand the benefits of new technologies – highlighting their environmental performance and accelerating their acceptance in Canada.

The program was implemented April 2007 and is currently in the last year of its four year run. To achieve its objectives, the eTV program works in partnership with vehicle manufacturers, industry associations, government departments and other stakeholders to undertake testing and evaluation of emerging vehicle technologies across Canada, in accordance with test procedures and best practices established by the Code of Federal Regulations, the Society of Automotive Engineers and the Electric Drive Transportation Association, among others.

Transport Canada's eTV program acts as a key link between industry and government, working to identify and address potential market barriers to the introduction of promising new passenger vehicle technologies in Canada. Key program activities include:

- Acquiring a range of emerging environmental light-duty advanced vehicles from a number of vehicle manufacturers, in order to test and evaluate their performance in Canada.
- Working in collaboration with industry to demonstrate vehicle use in real-world operating conditions, in order to assess the reliability and durability of these technologies in Canada.
- Identifying and addressing gaps, amendments and new requirements for codes, standards and regulations, to facilitate the adoption of these technologies in Canada.
- Working to increase Canadians' awareness of these technologies through outreach events, technology articles, newsletters, interactive websites, a technical glossary, educational curricula and other demonstration and development activities.
- Conducting studies and assessments to determine the environmental impacts and benefits of these technologies in Canada.

In the final year of the program's implementation, eTV will be undertaking a comprehensive strategy to identify promising electric vehicle technologies, including battery electric and plug-in hybrid electric vehicles.

The table below indicates the amounts that the Government anticipates the program could achieve. No GHG reductions were expected for 2008 due to the fact that program was in its first year of implementation and that activities of the program were not sufficiently advanced to yield actual GHG reductions.

Actual Reductions (Mt) for 2008	**NA**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.032	0.046	0.067	0.090
High	0.197	0.284	0.410	0.557
Expected	0.071	0.103	0.148	0.201

ecoENERGY for Fleets Program

The ecoENERGY for Fleets Program is investing $22 million over 4 years to generate reductions in fuel use and related costs, air pollutants and greenhouse gas emissions through measures targeted at both vehicle operators and managers of Canada's commercial and institutional road vehicle fleets. Such measures include training and awareness through the SmartDriver curriculum for fleet vehicle drivers and the Fuel Management 101 curriculum for fleet managers, sharing of best practices (e.g., presentations and workshops), and technical demonstrations promoting the adoption of existing and emerging new technologies.

The program was implemented April 1, 2007. The program is in its fourth year of operation and all components are implemented. In fiscal year 2009/10, over 7,200 commercial drivers participated in

SmartDriver training workshops and 275 participants took part in Fuel Management 101 workshops to promote greater uptake of transportation energy efficiency practices.

The expected reduction of GHG emissions for 2008 indicated in the 2009 KPIA report was between 0.22 and 0.31 Mt. The actual impact was lower than the estimated impact due to lower than expected uptake in the first two years of the program, which occurred as a result of delays in contracting a delivery agent for driver training. To mitigate this challenge, the program increased its internal delivery of training until a contract was successfully negotiated.

Actual Reductions (Mt) for 2008	**0.08**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Expected	0.14	0.16	0.16	0.16

ecoFREIGHT Program

The $61 million ecoFREIGHT program is helping to reduce the environmental and health effects of freight transportation through the use of technology. The program became effective April 2007. With the exception of the Marine Shore Power Program, all programs end in March 2011.

The program includes six initiatives:

1. National Harmonization Initiative for the Trucking Industry: identifying regulatory barriers and solutions in collaboration with provinces and territories, so that the Canadian trucking industry can embrace emissions-reducing technologies.
2. Freight Technology Demonstration Fund: establishing 12 cost-shared demonstration projects to test and measure new and underused freight transportation technologies in real-world conditions, and disseminating information to industry.
3. Freight Technology Incentives Program: providing cost-shared funding to companies and non-profit organizations in freight transportation for 28 projects to help them to purchase and install proven emission-reducing technologies.
4. ecoFREIGHT Partnerships: building and maintaining partnerships within the transportation sector to reduce emissions from freight transportation through fast and flexible voluntary actions that can support the regulatory framework.
5. Please see the section on the Marine Shore Power Program (page 26).
6. Please see the section on ecoEnergy for Fleets (page 23).

With respect to the National Harmonization Initiative for the Trucking Industry (NHITI), a number of studies were completed by Transport Canada on behalf of the provinces and territories examining the feasibility of mandating heavy truck speed limiters. They can be viewed at: www.tc.gc.ca/roadsafety/safevehicles/motorcarriers/speedlimiter/index.htm

Two provinces – Ontario and Quebec – have now implemented heavy truck speed limiter regulations. Transport Canada conducted significant foundational work under the NHITI to support this initiative and offered co-funding to assist with the development of enforcement capacity for these new requirements. Other provinces are considering speed limiter legislation, however no decision has been taken at this time on whether to proceed.

In addition, studies were completed relating to the assessment and testing of emerging environmental technologies to verify their environmental performance and compliance with regulatory requirements for on-road operation (e.g. rear trailer fairings [boat tails]). A study was also completed investigating the feasibility of requiring protective side guards on large trucks and trailers operating in Canada, including the potential environmental benefits of flush-mounted side fairings. This work provides

background information for removing barriers to the increased uptake of technologies that reduce trucking energy consumption and GHG.

Transport Canada also continued its involvement in the Task Force on Vehicle Weights and Dimensions Policy to improve uniformity in regulations governing the weights and dimensions of commercial vehicles operating between provinces and territories. The Task Force was instrumental to the modification of the track width requirement for axles fitted with wide-base single tires, which encourages truckers to experiment with this energy saving alternative. The Task Force, which made regulatory changes to allow 2-foot long boat tails in 2008, considers accommodating even longer boat tails, and is closely following Transport Canada's study assessing the environmental benefits and safety implications of longer boat tails.

The Freight Technology Demonstration Fund and Freight Technology Incentives Programs are fully operational. 40 projects are underway, providing $10.6 million in funding for a total project value close to $25 million. The projects cover a wide-range of best practices and technology applications such as aerodynamic technologies tested with freight industry; electrification opportunities explored (e.g. ground side equipment for airports/airlines); engine innovation (e.g. hybrid-electric powertrains, multiple generator locomotive engines), and best operating practices (e.g. anti-idling, driver behaviour).

Case studies based on current and previous generation projects information are being developed and posted on Transport Canada's web-site to share results with the freight industry.

In 2007, Transport Canada, Environment Canada, and the Railway Association of Canada signed a Memorandum of Understanding (MOU) to reduce the emissions of GHG and criteria air contaminants from locomotives operating in Canada. The MOU established 2010 GHG emission intensity targets for the major railway companies. For total freight train operations, the GHG emission intensity decreased by 25.7% in 2007 compared with the 1990 baseline.

In 2005, Transport Canada and the Air Transport Association of Canada (ATAC) signed a MOU that aims to limit or reduce GHG emissions from aviation in Canada and sets out a fuel efficiency improvement goal of 1.1% per year, with a cumulative improvement of 24% by 2012, compared with the 1990 base case scenario. Since the inception of the MOU, fuel efficiency improvement has reached a 1.9% annual fuel efficiency improvement in the passenger sector and 11% in the cargo sector. Under the framework of the MOU, Transport Canada continued to collaborate with domestic aviation industry organizations including ATAC and the National Airlines Council of Canada in advancing industry efforts to reduce emissions and in reporting on results achieved under the MOU.

Transport Canada has also been promoting environmentally responsible transportation decision-making to freight shippers and forwarders. This includes participation and sponsorship of environmental events and awards for shippers and freight forwarders, and the dissemination of information at event exhibits and on the ecoFreight website.

Transport Canada has continued to participate actively in international committees and working groups with a dedicated focus on greenhouse gas emission reductions. This includes: International Civil Aviation Organization, International Maritime Organization, Organization for Economic Cooperation and Development, International Transport Forum, Asia-Pacific Economic Cooperation, and the Commission on Environmental Cooperation.

Transport Canada has also provided support for the development of international environmental standards, practices and guidelines, contributing to the reduction of GHG emissions and air pollutants and the improved efficiency of the aviation and marine sectors under the auspices of the International Maritime Organization and the International Civil Aviation Organization.

Programs are being implemented as scheduled. With respect to the NHITI, it should be noted that as a national speed limiter mandate was not unanimously supported by all jurisdictions, mandatory

implementation is currently a province-by-province decision. As such, Transport Canada's ability to support full implementation is limited.

No GHG reductions were expected for 2008 due to the fact that program was in its first year of implementation and that projects funded under the program were not sufficiently advanced to yield actual GHG reductions.

Actual Reductions (Mt) for 2008	**NA**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.98	1.12	1.25	1.37
High	1.05	1.24	1.38	1.51
Expected	0.98	1.12	1.25	1.37

Marine Shore Power Program

The $6 million Marine Shore Power Program demonstrates the use of shore-based power for marine vessels in Canadian ports to reduce air pollution from idling ship engines in urban centres. The program was implemented April 2007 and ends in March 2012.

Following consultations with industry in Fall 2007, it was decided to delay the program funding round until after amendments to the *Canadian Marine Act* come into force so as to ensure that Canadian Port Authorities were eligible for funding. Therefore, the due date for applications for Round One funding was August 25, 2008. This program was implemented by the projected date (April 2007) and has been extended to 2012 to allow for full project completion.

Under this first funding round, the Vancouver Fraser Port Authority was selected to build a marine shore power installation on the East and West berth at their Canada Place facility. The construction was completed and the marine shore power installation has been available since the 2009 cruise vessel season. A second round of funding was held in the Fall of 2009 and a successful project has been selected for completion in 2011-12.

The table below indicates the amounts that the Government anticipates the program could achieve. No GHG reductions were expected for 2008 due to the fact that program was in its first year of implementation and that the project funded under the program was not sufficiently advanced to yield actual GHG reductions.

Actual Reductions (Mt) for 2008	**NA**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.003	0.004	0.004	0.004
High	0.003	0.004	0.004	0.007
Expected	0.003	0.004	0.004	0.004

Promoting Sustainable Urban Transit

The Public Transit Tax Credit (PTTC) allows individuals to claim a non-refundable tax credit for the cost of monthly public transit passes or those passes of a longer duration, effective July 1, 2006. The Credit was extended in Budget 2007 to electronic fare cards and weekly passes when used on an ongoing basis. The objectives for the measure outlined in Budget 2006 were to provide assistance to Canadians by making transit more affordable, to reduce traffic congestion in urban areas and to improve the environment by lowering greenhouse gas emissions.

The PTTC is fully implemented. The tax credit applies in respect of the cost of eligible public transit passes for travel occurring after June 30, 2006. The expansion of the credit to the costs of electronic fare cards and weekly passes when used on an ongoing basis became effective starting January 1, 2007.

Projected and actual reductions were tracked closely for 2008. The main difference between the estimated anticipated reductions and the estimated actual reductions is that the estimated actual reductions are based on the actual PTTC claims received. The estimate anticipated reductions are based on eligible trips.

Actual Reductions (Mt) for 2008	**0.032**			
Projected Reductions (Mt) for:	**2009**	**2010**	**2011**	**2012**
Low	0.033	0.034	0.034	0.035
High	0.033	0.035	0.036	0.038
Expected	0.033	0.034	0.035	0.036

Provincial and Territorial Collaboration and Action

The Government of Canada recognizes the important role that provinces and territories play in combating climate change. Provincial and territorial governments control many of the levers for action towards reducing greenhouse gas (GHG) emissions from a number key sectors, including electricity generation, residential, commercial and institutional buildings, transportation, agriculture, and waste management. As a result, successful actions to reduce greenhouse gas emissions necessitate a strong collaborative relationship between the Government of Canada and provincial and territorial partners.

Taken together, the Government of Canada, provinces and territories are currently pursuing a number of climate change initiatives across Canada. While there are some commonalities – for example, energy efficiency and conservation efforts often figure prominently – approaches to climate change vary greatly between provinces and territories. Quebec and British Columbia introduced carbon taxes on October 1, 2007 and July 1, 2008 respectively. In 2007, Alberta passed the *Climate Change Emissions Management Amendment Act* to regulate greenhouse gas emissions from large industry. Together, Alberta and Saskatchewan are making substantial investments in carbon capture and storage technology and are also pursuing regulatory frameworks. Ontario and Nova Scotia are taking action to reduce emissions from electricity generation, with Ontario phasing out the use of all coal-fired power plants and Nova Scotia putting in place regulated caps on greenhouse gas and air pollutant emissions from power generation facilities. Moreover, British Columbia, Manitoba, Ontario and Quebec, along with several American states, are participating in the Western Climate Initiative, which aims to create a common carbon market.

Clean Air and Climate Change Trust Fund

This section on the Clean Air and Climate Change Trust Fund addresses the descriptive requirements of paragraph 5 (1) (a) (iv) of the *Kyoto Protocol Implementation Act* to include measures respecting cooperative measures or agreements with provinces, territories or other governments as well as paragraphs 5 (1) (b) (i) and (ii).

In Budget 2007, the $1.5 billion Clean Air and Climate Change Trust Fund was established to support those provinces and territories that identify major projects that will result in real reductions in greenhouse gas emissions and air pollutants. Importantly, while the Government of Canada provided funding to provincial and territorial governments through the Trust, it is provincial and territorial governments themselves that are responsible for allocating the funds to specific programs. Further, the Trust Fund was established on an arms-length basis, and provincial and territorial governments are not required to report to the Government of Canada on how they used Trust Fund resources.

In the absence of reporting from provincial and territorial governments, previous iterations of this report contained initial estimates of reductions for the Trust Fund. However, following concerns raised by the Commissioner of the Environment and Sustainable Development about the Government's ability to robustly assess the impact of the Fund, the Government of Canada committed in last year's Plan to working directly with provinces and territories to bring greater clarity to this issue.

Towards this end, Environment Canada approached provinces and territories about quantifying reductions associated with the Trust Fund. These efforts have resulted in an improved understanding of how Trust Fund resources are being utilized.

Two types of approaches are apparent. First, some provinces and territories are using Trust Fund resources to directly finance specific projects. For example:

- Nova Scotia used its funds to establish ecoNova Scotia to support projects to reduce the emissions of greenhouse gases and air pollution. Through 69 funded projects and programs in

2009, the initiative is projected to reduce greenhouse gas emissions by 172 kilotonnes (Kt) a year.

- Alberta directed approximately $80 million of the fund towards 10 projects focussing on, among other goals, technology advancement and leveraging further investments. These projects are projected to provide 3 megatonnes (Mt) of reductions by 2015.
- Yukon directed its funds towards the installation of a third hydro turbine at the Aishihik hydro electric plant in south western Yukon. The Aishihik 3rd turbine will be operational by the end of 2010 and will produce 3.8 Kt of emission reductions annually.
- New Brunswick dedicated resources towards landfill gas recovery projects, with three of these projects using the captured methane gas for power generation. This will result in 165 Kt of GHG emission reductions.

Second, other provinces have used the Trust Fund to help finance their overall climate change strategies. For example, Trust Fund resources have been used:

- In Ontario to help finance a broad range of initiatives under its Climate Change Action Plan, including improving access to energy efficient technologies, increasing use of renewable energy sources, deploying new technologies to abate emissions, and public transit. Ontario has also committed to eliminate coal-fired generation by the end of 2014.
- In Quebec to provide additional funding for its suite of climate change measures under its 2006-2012 Action Plan on climate change. These resources have been added to Quebec's Green Fund, to supplement funds collected through the Green Fund duty.
- In Saskatchewan to support a wide variety of provincial investments being pursued towards the reduction of GHG emissions. These investments include the establishment of the Go Green Fund, which provides financial support for the development and deployment of clean energy technologies, energy efficiency initiatives, renewable energy and wind power projects, and carbon capture and storage projects.

To provide the most transparent reporting on the results of the Trust Fund, this report does two things. First, it summarizes (as per above) what each province or territory reported regarding their use of Trust Funds (provinces and territories not mentioned did not respond). Second, this plan takes into account all provincial and territorial actions that affect climate change emissions (both those funded by the Trust Fund and others) into the estimate of baseline emissions before accounting for other KPIA programs. This will provide the most transparent picture of what provinces and territories have done with the Trust Fund and ensure that all provincial and territorial action is taken into account when projecting the impact of federal action on GHG emissions.

Other Clean Energy and Infrastructure Investments

In addition to the Trust Fund, the Government of Canada is also working with provinces and territories through a number of other substantial investments in clean energy and infrastructure development. These initiatives are expected to reduce GHG emissions over the longer term and have an overall benefit for Canada's economy and environment. At this time, they are not expected to result in quantifiable reductions by 2012 – they are presented here for information.

Clean Energy Fund (CEF)

The Clean Energy Fund (CEF) was established by *Canada's Economic Action Plan* and provides $795 million over five years for research, development and the deployment of new, cutting-edge clean energy technologies. To date, the Clean Energy Fund has announced support for three large-scale carbon capture and storage projects, and nineteen demonstration projects of renewable and alternative energy technologies. These latter projects will demonstrate marine energy, smart grid, energy storage, bioenergy, geothermal energy in the North, and community energy systems.

At present, $612.1 million, or almost 80% of the available CEF funding, has been committed, translating into a potential CO_2 reduction of approximately 6 Mt per year by 2015. With the remaining funds, additional reductions are also expected in the post-Kyoto period.

Dedicated Investments towards Carbon Capture and Storage (CCS)

CCS is an integral component of Canada's domestic and continental efforts to reduce greenhouse gas emissions. Recognizing this, in Budget 2008, the Government of Canada provided $240 million to the Province of Saskatchewan to partner with industry to implement a full-scale commercial demonstration of CCS in the coal-fired electricity sector. In addition, Budget 2008 provided $5 million to the Institute for Sustainable Energy, Environment and Economy at the University of Calgary to work with a broad range of stakeholders on outstanding issues, and $5 million to support geological research in Nova Scotia to examine the potential for carbon storage in that province.

Government of Canada Investments in Green Infrastructure

The Government of Canada is also making significant investments in green infrastructure, such as public transit, solid waste management and green energy generation and transmission, which will contribute to reducing Canada's green house gas emissions.

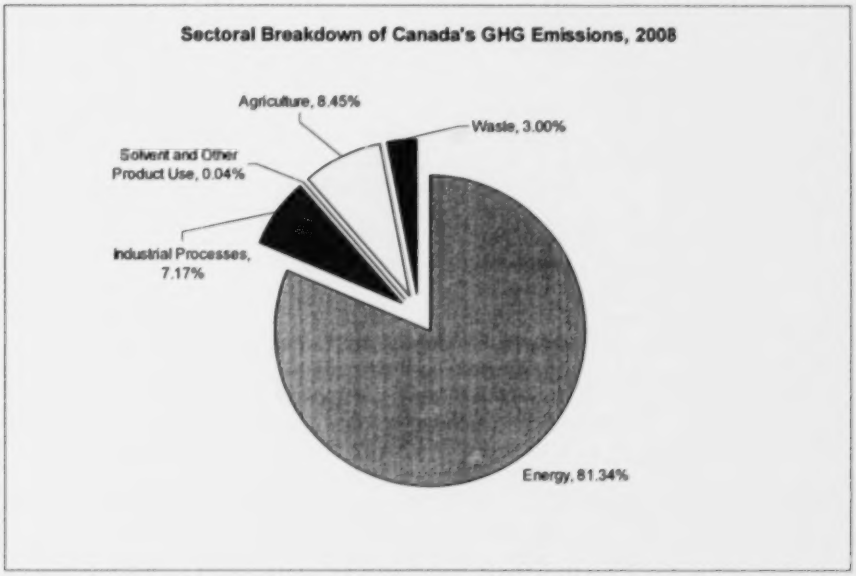
These investment funds include the:

- ***Green Infrastructure Fund***, established under Canada's Economic Action Plan, to fund projects that improve the quality of the environment and lead to a more sustainable economy over the longer term. www.buildingcanada-chantierscanada.gc.ca/media/news-nouvelles/2009/gif-fiv-eng.html.
- ***Infrastructure Stimulus Fund***, which provides funding to provincial, territorial, municipal and community construction-ready infrastructure projects. www.buildingcanada-chantierscanada.gc.ca/creating-creation/isf-fsi-eng.html
- ***Building Canada Fund***, which was designed to advance a stronger economy, a cleaner environment, and better communities, while addressing local and regional infrastructure needs. www.buildingcanada-chantierscanada.gc.ca/funprog-progfin/target-viser/bcf-fcc/bcf-fcc-eng.html
- ***Provincial-Territorial Base Fund,*** which provides each province and territory with stable and predictable funding for cost-shared projects that promote a stronger economy, a cleaner environment, and better communities. www.buildingcanada-chantierscanada.gc.ca/funprog-progfin/base/provfun-provfin/provfun-provfin-eng.html
- ***Gas Tax Fund***, which provides predictable and long-term infrastructure money to Canada's cities and towns and supports environmentally sustainable municipal infrastructure. www.buildingcanada-chantierscanada.gc.ca/funprog-progfin/base/gtf-fte/gtf-fte-eng.html

Canada's Greenhouse Gas Emissions in 2008

In 2008, Canada's greenhouse gas (GHG) emissions were 24% above 1990 levels. However, as in 2006, overall emissions declined modestly in 2008, following a pronounced shift upwards in 2007. This continues a trend observed since 2003 of fluctuating emissions and overall slower rates of emissions growth. GHG emissions are expected to remain relatively stable or trend downward during the 2009 period, due to the economic slowdown, and then start to rise slowly thereafter as a result of the economic recovery.

According to the latest National Greenhouse Gas Inventory, total greenhouse gas emissions in Canada in 2008 were approximately 734 megatonnes (Mt) of CO_2 equivalent, a decrease of 2.1% from the revised 2007 total (750 Mt).



The decline in emissions from 2007 can be partially attributed to the economic slowdown, which began in 2008. Between 2007 and 2008, the GDP for manufacturing dropped 5.7%. In addition, there were a number of small GHG emission reductions across a number of other sectors, such as transportation which has historically been a major source of emissions growth (between 1990 and 2008, emissions from this sector increased by 36.4%).

At the same time, GHG emissions from electricity and heat generation declined by 6.5 Mt from 2007 levels. This decline was attributable, in part, to increased hydroelectric power generation throughout Canada resulting from greater hydro-generating capacity associated with higher water levels (2008 was the 12th wettest year since 1948). Further, Ontario relied less on coal generation in 2008 than 2007 due to nuclear outages in 2007 which necessitated increased coal generation (and hence emission increases).

Nationally, average winter temperatures were cooler in 2008 than 2007, putting upward pressure on GHG emissions. Heating degree days (a measure of the amount of energy required to heat buildings) were up 11% from 2006, close to the high of 2003. The need for more heating fuel led to a 6% increase in greenhouse gas emissions over the same period from residential, commercial and institutional buildings. Further, a number of small emission increases over 2007 levels were observed

in 2008 in a number of industries, such as the Mining, Oil and Gas Extraction (2.9% increase from 2007 levels), Chemicals (16.6% increase), and Agriculture (2% increase), as well as in the areas of Off Road Diesel (9.4 % increase) and Railways (4.7 % increase).

Historically, while there have been relatively minor and short-lived dips in Canada's emissions (for example, in 1991 due to an economic recession, and in 2001 due to the impacts of the terrorist attacks of September 11, 2001), a change in trend is now apparent. Between 1990 and 2003, emissions grew at an average annual rate of 1.9%. Between 2003 and 2008, however, the trend shifted downward, with GHG emissions declining at an average annual rate of 0.8%:

As a result of the global economic recession, the pace of economic growth over the remainder of the Kyoto Protocol period is uncertain and difficult to forecast. At present, however, it is expected that the effects of the economic slowdown will cause GHG emissions to remain stable or trend downward during 2009. Emissions are then expected to rise slowly thereafter as a result of the economic recovery.

Estimating Emission Reductions

The Emissions Inventory for 2008 is the first for the Kyoto Protocol Reporting Period. However, because many of the measures detailed in this Plan were implemented in 2006, the early effects of those measures are also captured in the inventory data for 2008.

For this reason, we have developed a baseline for 2008 (and the following years) against which program impacts for 2008 can be evaluated. The 2008 baseline is an estimate of Canadian emissions for that year that excludes the effects of Federal Government programs announced after 2006 (i.e. those programs detailed in this report). This baseline does include in it the effects of significant government measures, such as federal measures announced before 2006 and all existing provincial government policies and programs, including those financed by the Clean Air and Climate Change Trust Fund discussed in an earlier section. This 2008 baseline can be compared against the 2008 Emissions Inventory to evaluate the effectiveness of measures. This is discussed in detail in Annex 2 of this report.

Canada's Emission Levels in 2008	
Year	***2008 Emissions***
Projected Emissions Excluding Federal Government Measures (Mt)	*736*
Actual 2008 Emissions (Mt)	*734*
Emissions Reductions Attributable to Federal Government Actions (Mt)	*2*

Canada's Emissions Levels from 2008 to 2012

In accordance with paragraph 5 (1) (c), the text and the table below set out Canada's projected greenhouse gas (GHG) emission levels for 2008 to 2012 and how these levels compare with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol. In addition to the expected reductions from federal GHG mitigation measures and policies, provincial plans and actions are expected to contribute to lowering Canada's emission levels over the period of 2008 to 2012. The projected emission levels will be verified by the National Inventory Reports, the first of which was submitted on April 15, 2010, with the final report for 2012 due on April 15, 2014. The degree to which Canada has met its emissions reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014.

Canada's allowable emissions under the Kyoto Protocol for the period 2008 to 2012 are 2,792 megatonnes (Mt).

The Government of Canada uses Environment Canada's integrated Energy, Emissions and Economy Model for Canada (E3MC) to estimate the reduction for the overall integrated package of measures. The modeled runs incorporated the individual initiatives and aggregated the results to estimate Canada's net emission reductions from a continuing trends baseline to report the remaining emission levels for 2009-2012. The use of the model responds to the National Round Table on the Environment and the Economy's (NRTEE) suggested methodological improvement for an "integrative accounting of the emission reduction estimates".

There are a number of key determinants that influence energy supply and demand, and emissions. These determinants include: the pace of economic growth; population and household formation; energy prices (e.g., world oil price and price of refined petroleum products, regional natural gas prices, and electricity prices); technological change and policy decisions. Varying any one of these assumptions could have a material impact on the energy and emissions outlook.

For purposes of sensitivity analysis, two key drivers were chosen: world oil price and economic growth. Economic growth is highly correlated with growth in energy and emissions. Likewise, oil price changes affect the macro-economy, as well as exerting an influence on consumer behaviour (e.g., a change in relative prices will encourage consumers to purchase more energy efficient products or reduce their overall energy consumption).

As a basis for assessing the additional reductions required to achieve the GHG emission reduction targets implied by the *Kyoto Protocol Implementation Act*, a baseline of projected emissions excluding government measures was constructed on the basis of the latest energy and emissions outlook. This baseline includes the effects of existing provincial government policies and programs, including those financed by the Clean Air and Climate Change Trust Fund, discussed in an earlier section, as well as federal measures announced before April 1, 2006. The combined impact of federal measures announced after April1, 2006 (and detailed in this report) is then estimated, to establish a projection of emissions including all measures to date.

EMISSIONS LEVELS – REFERENCE CASE

The projected emissions growth is highly dependent on forecasting assumptions such as the pace of economic growth and world oil prices. The short-term economic outlook underlying the emissions reference case is grounded in the GDP growth forecast contained in Budget 2010. The Department of Finance regularly surveys private sector economic forecasters on their views on the outlook for the Canadian economy. The economic forecasts reported in this budget, and which form the basis of the

Department's fiscal forecasts, are based on a survey that closed on December 18, 2009 and includes the views of 15 private sector economic forecasters.[8] Budget 2010 suggests that the near-term outlook is significantly different from that assumed for the 2009 economic outlook, as reflected in the 2009 KPIA report.

Change in Underlying Real GDP Growth between 2009 and 2010 KPIA Reports (in %)					
	2009	**2010**	**2011**	**2012**	**Average 2009-2012**
2009 KPIA Report (Budget 2009)	-0.8	2.4	3.4	3.1	2.0
2010 KPIA Report (Budget 2010)	-2.5	2.6	3.2	3.0	1.6

Under the reference case, the economy is projected to grow at 1.6% per year over the 2008 to 2012 period.[9] Over the same period, world oil price is assumed to average about $76 per barrel (in US$2008).[10] The natural gas price at Henry Hub is assumed to average about $6.3 per thousand cubic feet (in US$2008).

Under the reference case, ,Canada's baseline emissions levels (excluding the measures described in this report) would be expected to increase from 704 Mt in 2009 to 738 Mt in 2012. Through the federal measures presented in this report, emissions levels are expected to be about 3 Mt below the baseline at 701 Mt in 2009 and about 10 Mt below the baseline at 728 Mt in 2012. Given actual emissions for 2008 (i.e., 734 Mt) and the reductions anticipated from the measures in this report, Canada expects to be some 809 Mt above its Kyoto Protocol target of 2,792 Mt during the 2008 to 2012 period.

Canada's Emission Levels*					
Actual Reductions (Mt) for 2008		**2**			
Year	**2008***	**2009**	**2010**	**2011**	**2012**
Projected Emissions Excluding Federal Government Measures (Mt)	734	704	723	728	738
Expected Emissions Including Federal Government Measures (Mt)		701	718	720	728
Expected Emissions Reductions from Federal Measures (Mt)		3	5	8	10

* Actual emissions levels (includes the impact of Federal Measures)

[8] The December 2009 survey of private sector forecasters included Bank of America Merrill Lynch, BMO Capital Markets, Caisse de dépôt et placement du Québec, CIBC World Markets, The Conference Board of Canada, Desjardins, Deutsche Bank of Canada, Laurentian Bank Securities, Global Insight, National Bank Financial, Royal Bank of Canada, Scotiabank, TD Bank Financial Group, UBS Warburg, and the University of Toronto (Policy and Economic Analysis Program).

[9] This is significantly lower than the 2.2% per year growth rate assumed in the 2009 KPIA report and reflects the deep recession experienced in 2009.

[10] The world oil price in the 2009 KPIA report was assumed to average $75 per barrel, while the natural gas price at Henry Hub was assumed to average $6.7 per thousand cubic feet (mcf).

EMISSIONS LEVELS – ALTERNATIVE SCENARIO

Given the uncertainty concerning key modeling assumptions such as the pace of economic growth and world oil prices, an alternative scenario has also been constructed as a component of Environment Canada's sensitivity analysis.[11] In this alternative scenario, the economy is projected to grow at 1.7% per year over the 2008 to 2012 period (compared to 1.6% in the reference case). Over the same period, world oil prices are assumed to average about $98 per barrel (US$2008), compared to $76 per barrel (US$2008) in the reference case. Higher world oil and natural gas prices generally have the effect of increasing energy efficiency, thereby reducing emissions. Likewise, higher energy costs tend to increase the cost of production, thereby lowering manufacturing activity and resulting in lower emissions from these sectors of the economy. As an oil-exporting country, however, higher world oil prices will also stimulate increased oil and gas production activity in Canada, and increase emissions from that part of the economy.

Under this alternative scenario, the combined effect of higher energy prices, higher oil and gas production and higher economic growth result in somewhat lower emissions levels overall for 2009 and 2011, and somewhat higher emissions levels for 2010 and 2012 than in the reference case described above. For the Kyoto period, emissions under the alternative baseline are expected to increase from 703 Mt in 2009 to 738 Mt in 2012.

Under the alternative scenario, it is also assumed that the emissions reduction potential of the measures presented in this report are not fully achieved. The modeling, therefore, assumes that these measures achieve a level of expected reductions consistent with the "low" expected reductions, where indicated in this report.

As such, under this alternative scenario, emissions levels after taking into account the measures presented in this report are expected to be about 2 Mt below the baseline at 701 Mt in 2009 and about 9 Mt below the baseline at 730 Mt in 2012. Canada's emissions would therefore be 809 Mt above its Kyoto Protocol target of 2,792 Mt during the 2008 to 2012 period, the same level as under the reference case but with a different year-to-year profile of emissions and reductions.

Canada's Emission Levels Under the Alternative Scenario*

Actual Reductions (Mt) for 2008	**2**				
Year	**2008***	**2009**	**2010**	**2011**	**2012**
Projected Emissions Excluding Federal Government Measures (Mt)	734	703	723	726	739
Expected Emissions Including Federal Government Measures (Mt)		701	718	718	730
Expected Emissions Reductions from Federal Government Measures (Mt)		2	5	8	9

* Actual emissions levels (includes the impact of Federal Measures)

[11] In the construction of the alternative scenario, the key driver is the higher world oil price and natural gas price, and higher production levels in Canada's oil and gas industry.

Conclusion

With this document, the Minister of the Environment has responded to the publication requirements of Section 5 of the *Kyoto Protocol Implementation Act*. The Government's domestic agenda for reducing the country's greenhouse gas emissions is a balanced approach that focuses on long-term results in cohesion with the continental and global cooperation required to minimize the harmful effects of climate change.

Provision of Comments

Pursuant to paragraph 5 (3) (a) of the *Kyoto Protocol Implementation Act*, persons are welcome to submit comments about the report to the Minister of the Environment, care of:

Director General, Strategic Policy Branch
Environment Canada
22nd Floor – 10 Wellington St.
Gatineau, Quebec
K1A 0H3

Comments must be provided in writing by July 2, 2010.

Annex 1

Canada's Participation in International Climate Negotiations

A key part of Canada's approach to combating climate change involves active participation in international negotiations to reach consensus on a new global climate change regime.

In 2010, Canada will continue to work with the United States and other like-minded countries to develop a fair, effective and comprehensive post-2012 international climate change regime, guided by the following five principles:

- balance environmental protection and economic prosperity;
- maintain a long-term focus;
- develop and deploy clean technologies;
- engage and seek commitments from all major economies; and
- support constructive and ambitious global action.

The Copenhagen Accord – the main outcome of the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) – provides the foundation for an environmentally effective post-2012 international climate change agreement.

As of March 15, 118 countries representing over 83% of global emissions have associated themselves with the Accord and 77 countries have submitted mitigation commitments in the appendices of the Accord. These commitments comprise nationally-determined economy-wide mitigation reductions targets for 2020 by developed countries and nationally-appropriate mitigation actions by developing countries.

Canada has associated itself with the Copenhagen Accord and is committed to its full implementation. In accordance with this commitment, Canada has submitted an economy-wide emissions target of 17% below 2005 levels by 2020 that is fully harmonized with the emissions target of the United States, and remains subject to change to align with the final emissions target of the United States in enacted legislation.

Canada will provide funding to help developing economies reduce their emissions and adapt to climate change, as part of a collective developed country commitment under the Copenhagen Accord to provide up to US $30 billion for the 2010-2012 period.

Throughout 2010 Canada will continue to work with its international partners to maintain political momentum to enhance global action on climate change, including through the full implementation of following provisions of the Copenhagen Accord:

- development of a transparent and effective process for international review of mitigation and financing commitments;
- strengthening long-term financial architecture, including through the establishment of the Copenhagen Green Climate Fund and a High Level Panel to review options for long-term financing;
- establishment of a new international adaptation program that prioritizes the needs of the poorest and most vulnerable countries; and
- establishment of mechanisms to facilitate technology transfer and the reduction of emissions from deforestation and forest degradation.

The UNFCCC will remain the main forum for negotiations of a new, comprehensive, legally-binding global climate change agreement that builds on the Copenhagen Accord. A number of other informal ministerial meetings are likely to be held to help build consensus in the ongoing negotiations and to

enhance global action on climate change. Canada will remain actively and constructively engaged in the international negotiations and related meetings, in line with our key principles and objectives.

As President of the 16th Conference of the Parties to the UNFCCC (CoP16), Mexico will play a particularly important role in the international negotiations on climate change in 2010. Canada and Mexico have a close and productive working relationship in the area of climate change. Canada will work closely with Mexico to achieve a successful outcome at CoP16.

Annex 2

Methodology for Estimating the Expected Greenhouse Gas Emissions Reductions

Introduction

This Annex describes the approaches taken to calculate estimated reductions from the measures detailed in the report. Two types of estimation procedures were used. Reduction estimates have been calculated on a case-by-case basis for the individual measures in the document as per paragraphs 5 (1) b (ii) of the Act. In addition, Environment Canada's integrated Energy, Emissions and Economy Model for Canada (E3MC) was used to estimate the emissions reduction for the overall integrated package of measures and the modeled results were used to report on Canada's emission reductions and total remaining emission levels for 2008-2012, thereby satisfying paragraph section 5(1)(c) of the Act.

The advice of the National Round Table on the Environment and the Economy is a key factor in the Governments' methods for estimating reductions. The *Response of the National Round Table on the Environment and the Economy to its Obligations Under the Kyoto Protocol Implementation Act* (September 2007) suggested certain methodological improvements for the development and presentation of reasonably expected emission reductions. These included the following:

- Transparency and clarity regarding assumptions and methodologies.
- Consistency in accounting for emission reductions over the relevant time period.
- Integrative accounting of results, where all programs are assessed in an integrated manner and the overall contribution accounts for positive and negative interactions between measures and regulations.

Estimates for Reductions from Individual Measures

This section describes the methodology used to generate emissions reductions from individual measures as well the resulting emissions levels for Canada in 2008-2012 that are required under paragraphs 5 (1) b (ii) of the Act.

Expected reductions from individual measures were estimated by the responsible department, with related parameters incorporated into E3MC. The methodologies for each individual measure are described below.

The Light Duty Fuel Economy Regulation

Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations

The proposed passenger automobile and light truck greenhouse gas emission regulations would apply to companies that manufacture or import new passenger automobiles and light trucks of the 2011 and subsequent model years for the purpose of sale in Canada. The proposed standards will require substantial environmental improvements from new vehicles and would put Canadian GHG emission standards at par with U.S. national standards. Effectively, therefore, there will be common Canada-U.S. GHG emission standards beginning in 2012.

Through the implementation of the proposed standards, it is anticipated that the average GHG emission performance of the 2016 Canadian fleet of new cars and light trucks would achieve an

average level of 157 g CO_2/km (252 g CO_2/mile). This would represent an approximate 25% reduction compared to the new vehicle fleet that was sold in Canada in 2008.

Environment Canada's E3MC model was used to estimate the emissions reductions from the mandatory passenger automobile and light-duty truck greenhouse gas emission regulations. Actual sales-weighted and on-road fleet fuel economy performance for 2008 is included in the E3MC reference case. The sales-weighted fuel economy performance for cars and light-duty truck is from Transport Canada[12], while the on-road performance is from the Office of Energy Efficiency, Natural Resources Canada. E3MC has four broad vehicle categories: small cars, large cars, light-duty trucks and SUVs. For each category, E3MC has new vehicles sales, price of new vehicles, on-road stock, survival rates, average fuel economy performance, vehicle-kilometers travelled, energy use and associated emissions. These parameters are reported on an annual basis.

The modeling of the targeted reductions under the mandatory passenger automobile and light-duty truck greenhouse gas emission regulations was approached as follows:

- *Establishing the baseline:* To provide a robust projection of passenger automobile and light duty truck energy use, E3MC is calibrated using the most recent transportation data from Statistics Canada and the Office of Energy Efficiency. The model considers historic vehicle sales, cost, energy use and new vehicle fuel efficiency to project across vehicle classes. E3MC then aggregates these results and provides an overall outlook on vehicle performance and vehicle energy consumption. The baseline assumes a continuous improvement in new vehicle fuel efficiency driven by policy in the United States, energy prices and adoption of more efficient technology. E3MC explicitly models passenger automobile (i.e., small and large cars), light-duty truck and SUVs. Vehicle sales, cost, and new vehicle fuel economy performance were established for each category. Total energy use and related for the on-road stock for each vehicle class was projected.[13]
    - Under the business-as-usual (BAU) scenario, there are two possible assumptions for vehicle fuel performance. First, vehicle fuel performance remains at the CAFC standard for the entire period (i.e., 8.6 litres per 100 km for passenger cars and 10.2 litres per 100 km for light-duty trucks). Second, continuous improvement in fuel economy driven by policy in the United States, energy prices and more efficient technology. Given the influence of the US policy on the Canadian market, fuel economy of new vehicles is assumed to improve over the projection period.

- *Modeling the mandatory passenger automobile and light-duty truck greenhouse gas emission regulations:* The response of automobile manufacturers to the mandatory regulations is estimated using new vehicle fuel efficiency projections calculated based on cost-minimizing adoption of emission reducing technologies. Due to their relative cost-effectiveness, improvements in the emissions performance of air conditioning units in passenger vehicles and light-duty trucks are expected to be adopted by all automobile manufacturers. Specifically, the emission performance of air conditioning units is assumed to improve through both a reduction in refrigerant leakage and improved operating efficiency. Therefore, the total improvement in emissions performance of passenger automobiles and light-duty trucks is the combined effect of improvements to vehicle air conditioning units and the cost-minimizing adoptions of emission reducing technologies.

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[12] The Government of Canada, in conjunction with the motor vehicle industry, sets Company Average Fuel Consumption (CAFC) targets annually. The CAFC targets represent the maximum weighted average fuel consumption numbers for new light-duty vehicles. There are two annual CAFC targets for new light-duty vehicles - one for passenger cars and another for trucks. Historically, Canada's CAFC targets have been harmonized with the Corporate Average Fuel Economy (CAFE) standards in the United States. The current CAFC goal is 8.6 litres per 100 km passenger for cars and 10.2 km for light-duty trucks. For 2008, the sales-weighted performance for the fleet is 7.1 litres per 100 km for passenger cars and 9.5 litres per 100 km for light-duty trucks.

[13] Population over the age of 18 was chosen as a key driver for projecting energy use and associated emissions from passenger vehicles and light-duty truck. Statistical analysis shows that population over the age of 18 is the most highly correlated driver, and hence represents the "best-fit".

- *Targeted Reductions:* The reductions are assumed to be the difference between new fleet emissions performance in the BAU and the mandatory passenger automobile and light-duty truck greenhouse gas emission regulations. Given the choice of BAU emission levels for passenger and light-duty trucks, the estimated reduction levels could be considered as the "best" representation of the incremental impact of the mandatory regulation.[14] The estimated reductions explicitly capture effects such as the rebound effect (i.e., consumers driving greater distance than expected in the business-as-usual scenario due to lower driving costs) and additionality and free-ridership (i.e., the business-as-usual scenario assumes increasing efficiency, therefore, only the incremental impact of the regulations is captured).

Uncertainty Analysis

The analysis of the impact of the mandatory passenger automobile and light-duty truck greenhouse gas emission regulations is sensitive to assumptions regarding vehicle sales, technology options and associated costs, gasoline and diesel prices and market (consumers and manufacturers) behaviour. Given the numerous combinations and permutations, sensitivity analysis was done on energy prices and economic growth.

Regulating Energy Efficiency — Strengthening Energy Efficiency Standards

Methodology

For each product proposed for regulation, Natural Resources Canada calculates an initial estimate of the energy savings based on the following factors:

- Estimates of the current level of efficiency of the least-efficient most popular product (determined from internal studies, testing reports and industry data).
- Estimates of a proposed minimum performance level based on engineering studies and experience in other regulating jurisdictions.
- Expected sales or shipments of the product that do not comply with the prospective standard (based on industry data, technological change, and market analysis of trends).
- Aggregating on an annual basis the energy savings resulting from the sales of a compliant product.

Initial estimates are refined through the regulatory process, and the details are published in a Regulatory Impact Analysis Statement (RIAS). In addition, impacts for equipment labelling programs are estimated as a percentage of regulatory impacts, based on program analysis. Energy savings (by fuel) were converted to greenhouse gas reductions using standardized conversion factors.

Uncertainty Analysis

Projected reductions are provided as reflected in the RIAS (December 24, 2008). They were adjusted in the 2009 KPIA report to account for changes to regulatory timing (e.g., the inclusion of general service lighting under Amendment 10 resulted in a longer consultation period; the negotiated interim reduction in stringency for incandescent reflector lamps).

It should be recognized that though the estimated reduction profile (by year) has changed in response to regulatory and market conditions, the long-term greenhouse gas impacts of energy efficiency regulations are expected to be greater than previously estimated. The decline in expected reductions in the early years of the regulatory framework should be considered deferred rather than lost. Due to regulatory timing and the inclusion of general service lamps under Amendment 10, approximately half of the originally planned GHG savings have been deferred to later years, resulting in a lower

[14] Based on industry sources, some 40% of a model year is sold in the previous calendar year, with the remaining 60% being sold in the model year calendar year. As such, reductions are anticipated for 2010, resulting from the purchase of Model Year 2011 vehicles sold in 2010.

Regulatory Impact Analysis Statement-Adjusted Forecast for 2010 (relative to the Results-based Management and Accountability Framework). At the same time, however, the expected savings for these activities by 2020 are higher than originally expected.

Non-compliance with standards has been estimated and incorporated into program forecasts.

Description of Methodology for Identifying Actual Reductions for 2008

Results are based on projected reductions outlined in the RIAS (December 24, 2008) and estimated reductions attributable to complementary ENERGY STAR and EnerGuide labelling programs.

Regulating Renewable Fuels Content

Methodology

The anticipated reductions are based on the total volume of renewable fuels that would be required by the federal regulations, minus the volume of renewable fuels from finalized provincial regulations (as of March, 2010: ethanol: British Columbia, Saskatchewan, Ontario and Manitoba; biodiesel: BC, MB). The reduction estimate for 2010 is an approximation based on a September start date for the federal regulation. As for previous estimates, ethanol and biodiesel volumes in the market prior to 2010 are not accounted for.

The BAU scenario is based on an estimated growth in demand for gasoline, diesel fuel, heating distillate and for renewable fuels. The demand volumes for these fuels were calculated by starting with the actual demand for 2008 and applying growth rates. These growth rates were based on annual increases in demand, predicted in Natural Resources Canada's *Canadian Energy Outlook for the years 2008-2020.*

The estimated emission reductions were calculated by multiplying emission factors, provided from Natural Resources Canada's GHGenius model, by the renewable fuel volumes required to meet the federal and existing provincial mandates.

The emissions reductions attributable to provincial mandates were subtracted from the overall reductions to arrive at the incremental reductions due to federal actions.

Uncertainty Analysis

A range of greenhouse gas emission reductions was estimated based on either including or excluding the effect of provincial regulations on the incremental volume of renewable fuel volume required by the federal Renewable Fuels Regulations. The high estimate is the expected greenhouse gas emission reductions based on the total volume of renewable fuels that would be required by the federal regulations. The low estimate is the expected greenhouse gas emission reductions based on the total volume of renewable fuels that would be required by the federal regulations, minus the volume of renewable fuels from finalized provincial regulations (British Columbia, Saskatchewan, Ontario and Manitoba).

In addition, in updating the calculated estimated emissions reductions, assumptions were made regarding the distribution of the various types of renewable fuels, based on the current and planned production of renewable fuels in Canada.

It was also assumed that some level of imports, primarily from U.S., would be needed during the first three years of the regulations coming into force while domestic production capacity expands. The emissions factors used were based on Natural Resources Canada's GHGenius model, which models life-cycle emissions based on various input parameters and pathway assumptions. The emissions factors are presented in the following table.

Emissions Factors Used (based on Natural Resources Canada's GHGenius model)	
Renewable Fuel Type	**Emission Factor Mt CO_2e per billion litres renewable fuel**
Corn Ethanol	1.19
Wheat Ethanol	1.47
U.S. Central Ethanol (corn)	0.74
Canola Biodiesel	2.88
Soy Biodiesel	2.68
Tallow Biodiesel	3.24

ecoENERGY for Renewable Power

Methodology

GHG emission reductions were estimated using the following equation:
GHG emission reductions = Renewable energy production × GHG emission factor

To calculate GHG emission reduction for future years, "renewable energy production" is estimated based on total capacity deployed from various renewable sources, multiplied by the expected capacity factor of each technology.

Uncertainty Analysis

The GHG emission factor used for the estimates of GHG reductions is based on the GHG emission intensity of marginal electricity generation in each province (because it is assumed that incremental renewable power generation replaces existing generation at the margin). To obtain a national factor, the emissions factor for the marginal fuel in each province was weighted by the provincial share of electricity generation and then summed. Thus, a cross-Canada GHG emission factor of 465.88 t/GWh was used. The value of the emission factor used directly influences estimates of GHG reductions. Any uncertainties in the emissions factor, therefore, have a direct impact on the uncertainty of the emissions estimate.

The program is designed to encourage 14.3 terawatt-hours of electricity production per year by 2011-2012 (translates to about 4000 megawatts of renewable power capacity). The terawatt-hour target is directly related to the program's transfer payment budget of $1.43 billion through a production incentive equivalent to 1 cent per kilowatt hour. Consequently, the calculations of GHG emissions are related to the amount of electricity produced on a yearly basis (i.e. GWh or TWh) and the transfer payments made to recipients.

The amount of electricity produced is dependent on two key factors:

1) The amount of megawatts from each of the renewable sources (wind, hydro, biomass, solar PV etc.) and when these megawatts come on line or are commissioned; and

2) The expected capacity factor for each technology.

The uncertainties surrounding these factors and how they were mitigated at the program development stage are described below:

1) For each year (2007 to 2011), the program estimated certain megawatts (MW) of capacity per technology coming on line or commissioned. About 4000 MW of projects were expected to be commissioned by March 31, 2011, which is the end of the implementation period for program. The expectations surrounding the type and timing of projects coming on-line were based on industry consultations, technical expertise and on intelligence from the Wind Power Production Incentive program.

2) Most renewable energy sources are intermittent and each renewable technology has a different capacity factor[15]. During program design, the capacity factors used for each technology type were based on consultations with industry, recommendations of the Commissioner of the Environment and Sustainable Development, and experience from the Wind Power Production Incentive program. As a result, each technology has a maximum limit on the capacity factor.

The uncertainties surrounding the low and expected Mt reductions take these two factors into consideration.

Description of Methodology for Identifying Actual Reductions for 2008

Actual reductions for the ecoENERGY for Renewable Power program are based on the eligible production submitted for payments by eligible recipients. In 2008, the total production from renewable power projects was 2,891 GWh, which when multiplied by the emission factor of 465.88/GWh equals 1.35 Mt of reductions.

ecoENERGY for Renewable Heat

Methodology

GHG emission reductions were estimated based on the number of expected projects, associated energy savings, and an emission factor for displaced fuel.

Uncertainty Analysis

The uncertainties surrounding the program's GHG reduction estimates and how they were mitigated at the program development stage are described below.

1) The estimate for the expected number of projects to be supported by the program was based upon experience with the Renewable Energy Deployment Program Initiative (REDI) program, knowledge of the solar thermal industry and the level of program funding. The expected GHG reductions were based upon assumptions that the program would support the deployment of 700 solar thermal units (air and water heating) in the institutional, commercial and industrial sectors, and complete eight residential pilot projects.

2) Expected energy savings resulting from the supported projects were based upon modeled results of completed projects under the REDI program. For residential pilot projects, the energy savings per house were based upon the simulated energy yield of residential solar products.

3) Emission factors for displaced fuels: the relative proportion of displaced fuels for projects supported by the program was based upon projects completed under the REDI program, and

[15] The capacity factor relates actual electricity produced to the theoretical total capacity of a power installation and is expressed in percent. The higher the capacity factor, the higher the production of electricity per megawatt of capacity. As a simplified example, if the wind is expected to blow 30% of the time, a wind turbine would have a capacity factor of 30%.

on the energy mix for hot water in Canada's commercial and residential sectors as per the Energy Use Data Handbook published in June 2005. The value of the emission factors used for fuels has a large degree of influence on estimates of GHG reductions.

Description of Methodology for Identifying Actual Reductions for 2008

GHG emission reductions were estimated based on simulations using actual project data from installed systems and software, such as RETScreen, SWIFT, WATSUN, Polysun, TrynSys, and others.

ecoENERGY for Buildings and Houses

Methodology

This program has several elements whose impacts were calculated individually.

- Buildings Component:
  - **New Buildings** - The anticipated impact of the updated energy code for buildings is based on: estimates of the energy efficiency gains of the updated code over the previous energy code, forecasts of new commercial and institutional floor space, and an estimate of the compliance rate to the building code. In addition, the building design validation service is expected to increase overall efficiency and energy savings compared to normal construction processes. Energy savings are estimated by using the expected number of building designs validated over the four-year period, the average floor space of these buildings and the average expected energy savings per unit of floor space.
  - **Existing Buildings** - The anticipated impact of energy benchmarking was estimated using: the expected number of buildings labelled during the pilot project, the average energy use of buildings participating in a typical Office of Energy Efficiency (OEE) buildings program, and the expected percentage of improvement in energy efficiency. The anticipated impact of training and information workshops was estimated using: the expected numbers of participants reached and the number of buildings they represent, the average energy use of buildings participating in a typical OEE buildings program, and the expected percentage age of improvements in energy efficiency.

- Houses Component:
  - **New Housing** - The expected energy savings per house was calculated by comparing the average energy consumption of National Building Code-compliant new houses with the energy consumption of houses rated under the R-2000 and EnerGuide labelling categories for energy-efficient homes. To obtain total energy savings, the savings per house is multiplied by the number of houses expected to be built and labelled. The impact of training on general construction practices is also calculated, based on program data, market trends, follow-up with participants and forecasted housing starts.
  - **Existing Housing** - Overall energy savings were calculated by taking the average energy savings resulting from actions taken as a result of energy evaluations and the expected improvements per evaluated home and multiplying these savings by the number of homes expected to be evaluated each year.

Uncertainty Analysis

Projected reductions are provided as a range to reflect the inherent risks involved in program implementation. Expected reductions represent conservative estimates of program impacts.

In the building sector, the estimates face uncertainties that are explained below:

- Buildings Component:
  - Updated energy code: Estimates are based on investment data provided by Informetrica Ltd. Estimated compliance rates with building energy codes are based on American studies. Finally, floorspace growth is highly dependent on economic cycles; forecasted floorspace growth may not fully reflect the economic situation that prevails during program implementation.
  - Energy Benchmarking and Training and information workshops: The expected energy efficiency is based on international studies related to impacts of information and awareness programs. The most conservative number was used.
  - A study to measure impacts of information and awareness programs is currently being conducted. This will enable program officials to better estimate energy saved as a result of such initiatives, as well as free-ridership and spill-over effects.

Description of Methodology for Identifying Actual Reductions for 2008

Housing Component: Results are based on actual program participation.

Buildings Component:

- New Buildings
  - Actual updated code impact is based on:
    - an assessment of the energy efficiency gains of the updated over the previous building code;
    - estimates of commercial and institutional floorspace construction; and
    - an estimate of the compliance rate to the building code.
  - The actual impact of the building design validation service is calculated using the actual energy efficiency gains of the designs over the current building code.

- Existing buildings
  - The actual impact of benchmarking is estimated using:
    - the actual number of buildings labelled in the pilot project;
    - the energy use of the labelled buildings before being labelled; and
    - the expected percentage of improvement in energy efficiency.
  - The actual impact of training and information workshops is estimated using:
    - the numbers of participants reached;
    - the average energy use of buildings participating in a typical OEE program; and
    - the expected percentage of improvement in energy efficiency.

ecoENERGY Retrofit Initiative

Methodology

Projected reductions from this program were estimated using information from technical and past program files, specifically, the average savings and participation rates for each sub-component of the initiative, subject to the limitations of the program design.

Homes Component: The estimate of emissions saved was based on the expected energy savings per house multiplied by the number of houses expected to participate in the program. Energy savings were based on Natural Resources Canada's program experience in this area, while the number of houses was estimated using a combination of past program participation and current funding levels.

Small and Medium Organizations – Buildings and Industry: The impact estimates represent the expected average energy savings per project multiplied by the expected number of projects, based on experience with past program participation and subject to current funding levels.

ecoENERGY Retrofit – Existing Buildings Initiative: the estimated energy reduction was based on actual proposals received, and their associated energy reduction estimates.

Uncertainty Analysis

Free-ridership was initially expected to have minimal influence on expected GHG reductions. This is due to incentive eligibility being designed to minimize this practice (e.g., requiring a minimum 1 year project payback period for those Small and Medium Organization projects receiving funding; requiring a pre-project energy assessment or audit; not incenting projects that begin prior to official approval being received from Natural Resources Canada).

Projected reductions are provided as a range to reflect the inherent uncertainty and risks involved in program delivery. Expected reductions represent a conservative estimate of program impacts.

For ecoENERGY Retrofit – Homes, the range is based on different calculated GHG reductions per house, specifically: Low: 2.9 t CO_2e/house, High: 3.4 t CO_2e/house and Expected: 3.3 t CO_2e/house (the methodology accounts for the budget increases).

Small and Medium Organizations (SMO): Average project size estimates proved to be over-estimated, as SMO projects submitted are at a lower average size than expected. In order to increase the number of project submissions and meet energy reduction targets, the program intensified and targeted promotion, accelerated approval processes in order for proponents to start their projects faster, eliminated the 12-month waiting period for subsequent projects proposals and signed collaboration agreements with provincial energy efficiency programs. These mitigating activities had positive impacts on a number of project submissions, as it is estimated that the number of projects will be 50% over the original estimates. However, the total energy reduction will be lower than the initial estimates.

ecoENERGY Retrofit includes the final year of the Existing Buildings Initiative, a program that began in 1998. The 2008 results (ascribed to ecoENERGY Retrofit) were not fully met, as many proponents withdrew their projects due to the end of the program.

Description of Methodology for Identifying Actual Reductions for 2008

Results are based on actual program participation.

ecoENERGY for Industry

Methodology

Estimated reductions were calculated by multiplying the average energy savings per participating facility (based on technical studies and past program files) by the expected number of participants for the informational and the instructional elements of the program. Energy savings (by fuel) were converted to GHG reductions using standardized conversion factors.

These calculations for estimating avoided emissions were done separately for the two program components: (1) energy savings from the Canadian Industry Program for Energy Conservation (CIPEC) and (2) energy savings from site-specific energy assessments.

Uncertainty Analysis

Preliminary expected reductions are provided as a range to reflect two possible scenarios regarding the types of industrial firms that participate in both the CIPEC program and the site assessments. High-end expected reductions include large final emitters (LFEs) participating in both sub-initiatives, while the low-end expected reductions include non-LFE participation only. The expected reductions in the Preliminary Expected Reductions table represent conservative estimates of program impacts.

Description of Methodology for Identifying Actual Reductions for 2008

Results are based on actual program participation.

ecoENERGY for Aboriginal and Northern Communities

Methodology

The ecoENERGY for Aboriginal and Northern Communities Program will assist in the development of installed electrical generation in Aboriginal and northern communities. It is anticipated that once all projects supported by the program are commissioned, the resulting displacement of natural gas, coal and diesel-electric generation will produce a 1.3 Mt reduction of greenhouse gases emissions of over the project life-cycle (assumed to be 20 years).

Estimated Mt reductions from this program are estimated using information provided in project proposals when submitted by proponents. Each proponent is required to submit detailed data in their proposals, with separate requirements for renewable power projects and energy efficiency projects. A data requirements document is provided to proponents to assist in the collection of information. It is recommended that proponents submit a RETScreen[16] analysis with their proposals. GHG reduction estimates provided in proposals are submitted for a technical review by a third party and it is the reviewed estimates that are reported for the program.

Renewable Energy Projects

GHG emission reductions = Project Electricity Production × GHG Emission Factor

GHG emission reductions estimates are based on:

1) Expected total capacity deployed from various renewable sources;
2) Expected renewable energy production; and
3) An emission factor based on avoided fuels.

Energy Efficiency Projects

GHG emissions reductions = Baseline Emissions – Calculated Project Emissions

Uncertainty Analysis

For Aboriginal and northern communities, there are three general possibilities for electricity sources: central grid system (e.g. provincial grid), isolated grid system, and off-grid / on-site generation. This information is critical for the Program's estimates as the source of electricity (coal, diesel, hydro) has an impact on the GHG emission factor.

For projects with an Isolated Grid or Off-Grid / On-Site Generation, and where the fuel consumption per MWh is not available, the calculations for the average grid emission factor assume that 1 MWh of electricity is equivalent to 3600 MJ.

The fuel-specific combustion emission factor is obtained from Environment Canada's GHG Inventory.

Fuel Energy content (e.g. MJ / m^3) is obtained from the Alberta Greenhouse Gas Reporting Program Guidance (1st draft, June 2003).

[16] RETScreen Clean Energy Project Analysis Software is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software is used to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs).

Energy Efficiency Projects

The project proponent decides if the baseline energy consumption will be estimated using system specifications or if historic metered data will be used.

When historical baseline energy consumption data is used, all factors external to the project (climate, occupancy levels, levels of production, etc.) that will affect energy consumption must be identified and historical data adjusted according to how these external factors have changed. This adjustment is needed to ensure that changes in these external factors are not misinterpreted as Energy efficiency savings. Techniques for adjusting baseline data can be found in the International Performance Measurement and Verification Protocol (IPMVP), 2007 edition.

Once the baseline energy consumption has been determined, baseline emissions are calculated as follows:

Baseline emissions = Total Energy Consumption x GHG Emission Factor

It is assumed that the source of electricity consumed in both the project and baseline cases is the same and thus the same emission factor would apply (since an energy efficiency project affects how much electricity is consumed, not where it came from).

ecoAUTO Rebate

Methodology

To calculate the anticipated greenhouse gas emissions reduction from the ecoAUTO rebate program, Transport Canada used the North American Feebate Analysis Model. Like Environment Canada's Energy-Economy-Environment Model for Canada (E3MC), the model used by Transport Canada approximates consumers and manufacturers decisions using Qualitative Choice Theory. These decisions are based on the price of buying and operating a vehicle compared with the perceived trade-off between energy savings through improved efficiency and the incremental capital and operating costs. In order to determine the impact of the policies on greenhouse gas emissions, Transport Canada's model incorporates a simplified version of Natural Resources Canada's Champagne model, a light-duty vehicle stock-accounting framework.

In the North American Feebate Analysis Model, the impact of the policy is estimated against a "base case" scenario where the model is run without any policy intervention. With everything else being held constant, all the changes in the values observed are associated with the policy. The model will compare the characteristics of a vehicle, its use, and actual sales number, with or without the policy. This in essence is how the analysis takes into account the free-rider issue. The estimate of annual greenhouse gas emissions reductions due to the ecoAUTO rebate program is calculated by using the difference between the annual emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario. The resulting difference gives the incremental, annual emission reductions attributed to the ecoAUTO rebate program.

The model used for this analysis was calibrated to the most up-to-date database available reflecting the characteristics of 2003 model-year vehicles available for sale in the North American market (Canada and United States). These vehicles are then "modified" with new fuel efficient technologies through time, using assumptions about consumer preferences, fuel price, technology cost, fuel consumption improvements, and industry production plans reflecting decision-making in a North American market.

Manufacturers' response is estimated by estimating how 2003 model-year vehicles evolve through time, given assumptions about how often vehicles are modified, and what are the costs associated with increasing a vehicle's fuel efficiency. Given that the ecoAUTO program was announced in Budget

2007 and was in effect for less than two years, the assumption has been that the program has not prompted manufacturers to modify their vehicles in any significant way due to the short lead time and the two-year length of the program. Although there is anecdotal evidence that some manufacturers did make some marginal modifications to their vehicles during the course of the program to qualify for the rebate, the assumption used in the model is that the program had no impact on manufacturers' decisions about the vehicles they made available to consumers over the last two model years.

Uncertainty Analysis

The analysis of the impact of the ecoAUTO rebate program is sensitive to assumptions regarding vehicle operating cost and market (consumer and manufacturer) behaviour. Uncertainty analysis was conducted to estimate the potential impact of variations to those assumptions on the greenhouse gas reduction estimates. The following is a description of the assumptions made by Transport Canada for the "Low", "Expected" and "High" cases. Those cases represent sensitivities to the most recent development in fuel prices and the impact of changes in operating costs on vehicle use (the rebound effect).

In Transport Canada's model, consumer behaviour is represented by assumptions about consumers' price elasticity of demand, their valuation of potential fuel savings, and the rebound effect.

Changes in fuel costs have a direct impact on the potential fuel savings achieved when reducing a vehicle's fuel consumption – for a given change in fuel consumption, a higher fuel price will lead to higher savings. The $0.80 per litre fuel price represents the Canadian average motor gasoline prices for the 12-month period ending in November 2004, which was the time period when the 2003 model-year vehicles were manufactured and sold. The fuel price of $1.10 per litre represents the average gasoline prices observed in Canada from March 2007 (introduction of the ecoAUTO program) to December 2008.

The combination of the high price without allowing manufacturers to implement incremental technology improvements defines the low and expected impact case as it is expected that the policy will have a smaller incremental effect on consumers in this situation.

In addition, for all cases, the analysis now assumes that the rebound effect of better fuel efficiency is 15%, rather than the 23% that was used in the preliminary estimates done when the program was developed in 2006. This change stems from recent studies suggesting that the rebound effect is lower than previously thought. In addition, in making its fuel economy ruling for model-year 2011, the United States National Highway Traffic Safety Administration has also chosen to use a 15% rebound effect as its expected value.

	***Low* Case**	***Expected* Case**	***High* Case**
Fuel Prices (¢ per litre)	110	110	80
Rebound effect	-0.15	-0.15	-0.15

Green Levy

Methodology

To calculate anticipated greenhouse gas emissions reductions from the Green Levy, Transport Canada used the North American Feebate Analysis Model. Like Environment Canada's Energy-Economy-Environment Model for Canada, the model used by Transport Canada approximates consumers and manufacturers decisions using Qualitative Choice Theory. These decisions are based on the price of buying and operating a vehicle compared with the perceived trade-off between energy savings through improved efficiency and the incremental capital and operating costs. In order to determine the impact of the policies on greenhouse gas emissions, Transport Canada's model incorporates a simplified version of Natural Resources Canada's Champagne model, a light-duty vehicle stock-accounting framework.

In the North American Feebate Analysis Model, the impact of the policy is estimated against a "base case" scenario where the model is run without any policy intervention. With everything else being held constant, all the changes in the values observed are associated with the policy. The model will compare the characteristics of a vehicle, its use, and actual sales number, with or without the policy. This in essence is how the analysis takes into account the free-rider issue. The estimate of annual greenhouse gas emissions reductions due to the Green Levy are calculated by using the difference between the annual emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario. The resulting savings are incremental, annual emission reductions attributed to the Green Levy.

The model used for this analysis was calibrated to the most up-to-date data available reflecting the characteristics of 2003 model-year vehicles available for sale in the North American market (Canada and United States). These vehicles are then "modified" with new fuel efficient technologies through time, using assumptions about consumer preferences, fuel price, technology cost, fuel consumption improvements, and industry production plans reflecting decision-making in a North American market.

Uncertainty Analysis

The analysis of the impact of the Green Levy program is sensitive to assumptions regarding vehicle operating cost and market (consumer and manufacturer) behaviour. Uncertainty analysis was conducted to estimate the potential impact of variations to those assumptions on the greenhouse gas reduction estimates. The following is a description of the assumptions made by Transport Canada for the Low, Expected and High cases. These cases represent sensitivities to the most recent developments in fuel prices and the impact of changes in operating costs on vehicle use (the rebound effect).

In Transport Canada's model, manufacturers' technology response is estimated by simulating how 2003 model-year vehicles are modified through time, given assumptions about how often vehicles are retrofitted (generally over a four to five years schedule), and what are the costs associated with increasing a vehicle's fuel efficiency. The sensitivity analysis of the Green Levy now includes a technology response of the policy for the high case. Inclusion of the technology effect in the analysis has the consequence of progressively increasing the impact of the program, as more retrofitted vehicles enter the fleet.

Consumer behaviour is represented by assumptions about consumers' elasticity of demand, their valuation of potential fuel savings, and the rebound effect.

Changes in fuel costs have a direct impact on the potential fuel savings achieved when reducing a vehicle's fuel consumption – for a given change in fuel consumption, a higher fuel price will lead to higher savings. The $0.80 per litre price represents the Canadian average motor gasoline prices for the 12-month period ending in November 2004, which was the time period when the 2003 model-year vehicles were manufactured and sold. The fuel price of $1.10 per litre represents the average gasoline

prices observed in Canada from March 2007 (introduction of the Green Levy) to December 2008. In 2009, average retail fuel prices in Canada were approximately $0.95 per litre, well within our range of estimates.

The combination of the high price while allowing manufacturers to implement incremental technology improvements defines the High case as it is expected that the policy will have more incremental effect on consumers in this situation. The assumptions made in the High scenario lead to the greatest impacts by 2012 due to technology adoption. The Low and Expected scenarios' assumptions yield a greater initial impact in 2008 due to lower fuel prices, but do not yield as much impact over the longer term.

In addition, for the High case, the analysis now assumes that the rebound effect of better fuel efficiency is 15%, rather than the 23% that was used for the preliminary estimates that were provided in 2006. This change stems from recent studies suggesting that the rebound effect is lower than previously thought. In addition, in making its fuel economy ruling for model-year 2011, the United States National Highway Traffic Safety Administration has also chosen to use a 15% rebound effect as its expected value.

	Low Case	***Expected* Case**	***High* Case**
Fuel Prices (¢ per litre)	80	80	110
Rebound effect	-0.23	-0.23	-0.15

ecoENERGY for Personal Vehicles Initiative

Methodology

The program interventions include a number of elements whose impacts were calculated individually. The estimated energy savings of program interventions were calculated based on the expected number of drivers reached by the program, the changes in their behaviour resulting from the program, and the fuel saved because of these changes.

Government publications, accepted models, technical studies and past program files provided information regarding these variables and the basis for the estimates of participation, rates of adoption, retention of fuel-efficient practices, and the average impact of these practices.

The goal under the Memorandum of Understanding (MOU) of reducing GHG emissions by 5.3 Mt is a negotiated target that was initially based on the emissions reductions that could be expected from a 25% improvement in fuel efficiency in 2010. The 5.3 Mt target is measured from a "reference case" level of emissions that is designed to reflect the actions of the automotive industry that would have occurred in the absence of action on climate change. A joint government-industry monitoring committee will employ an analytical framework to calculate the reference case out to 2010 and compare these emissions to actual levels.

Uncertainty Analysis

The Government of Canada has a number of programs designed to reduce GHG emissions from the transportation sector. These programs are designed to be complementary. Preliminary expected reductions represent conservative estimates of program impacts.

In the case of the MOU, GHG emissions from the personal vehicle fleet in 2010 are influenced by both external factors (such as the number of new vehicles sold and how much Canadians drive) and internal factors that the auto industry can control (like the fuel efficiency of vehicles sold and the type of fuel they use). Since the MOU is based on a specific goal of 5.3Mt, there is no High to Low range.

Description of Methodology for Identifying Actual Reductions for 2008

Results are based on actual program participation.

ecoMOBILITY Initiative

Methodology

Transportation Demand Management (TDM) is the application of strategies and policies to reduce automobile travel demand, or to redistribute this demand to other modes. The program will achieve its GHG impact by funding TDM initiatives that reduce the distance (VKT) traveled by passenger vehicles in urban areas. It can be a cost-effective alternative to increasing road infrastructure capacity, and can help maximize the benefits of existing infrastructure. It is important to note that the effect of the ecoMOBILITY program is linked with the availability of alternatives to personal vehicles. Certain transit-based TDM strategies must be implemented in close collaboration with transit investments, while other strategies such as teleworking and other workplace programs can be implemented more independently. Canada's Economic Action Plan, including the $4 billion Infrastructure Stimulus announced in Budget 2009, supports accelerated investments in public transit infrastructure that should contribute to greenhouse reductions over the longer term. The ecoMOBLITY program will focus its activities on non-transit based TDM strategies that can be delivered in parallel to accelerated infrastructure projects rather than seek to introduce complexity or delays in these major projects through the demonstration and impacts reporting of incremental transit-based TDM strategies.

In 2006, it was assumed that the program could support a reduction in total VKT in urban areas by 3% in 2010 through the direct and indirect (transformative) effects of the program activities. This assumption came from the "high TDM" option outlined in a study commissioned by Transport Canada (*The Impact of Transit Improvements on GHG Emissions: A National Perspective*, Transport Canada, March 2005). This option assumed that both transit and non-transit TDM measures would be implemented by municipalities in combination with significant transit infrastructure investments. The 3% reduction was applied to historical VKT data available from Natural Resources Canada, the results were translated into reductions in fuel use and subsequently GHG reductions using Environment Canada conversion factors. This methodology yielded a preliminary estimate of 1.6 Mt in 2012. The current program approach to focus on a narrower range of non-transit based TDM strategies will necessarily lower GHG emission reductions that will be attributable to the program in 2012.

Uncertainty Analysis

Sensitivity analysis was conducted on the assumptions made about VKT reductions. An expected scenario assumes a 0.2% reduction of VKT in 2012 yielding an estimated 0.112Mt reduction. A higher scenario assumes a VKT reduction of 0.4% yielding an estimated 0.223 Mt inn 2012. Because the selection of projects under the program was initially delayed to allow for more national consultations in 2007, it is also unlikely that the project implementation will be sufficiently advanced to yield GHG reduction in 2009.

National Vehicle Scrappage Program

Methodology

Projected GHG reductions are only a co-benefit as the focus of the program is on reducing smog-forming emissions, not greenhouse gas emissions. GHG emissions reductions are the result of individuals retiring their old vehicle and either choosing sustainable forms of transportation (such as public transit or membership in a car-sharing program) or replacing their old vehicle with a more fuel-efficient one and/or driving less.

Reductions are the difference between emissions from the older, retired vehicle and its replacement, which can be either another vehicle mode of transportation or another vehicle. Post-vehicle retirement behaviour is measured through surveys of program participants six to twelve months after they retire their old vehicles. Reductions are estimated through a database developed specifically to manage the program and track results. Published data for emission factors for vehicles (by model and model year), annual vehicle use (average distance driven), and transit data (distance travelled and fuel consumed by buses) are the basis for the calculations.

Uncertainty Analysis

Emissions estimates vary depending on the number of program participants, the incentive selected, and personal transportation behaviours after the old vehicle has been retired.

Description of Methodology for Identifying Actual Reductions for 2008

Reductions are the difference between emissions from the old, retired vehicle and its replacement (either a replacement vehicle or other transportation options, such as transit or car-sharing). Transportation behaviour is estimated from surveys of program participants 6 to 12 months after they retired their older vehicles. Reductions are estimated through a database developed specifically to manage the program and track results. Published data for emission factors, annual vehicle usage, and transit data are the basis for the calculations.

ecoTECHNOLOGY for Vehicles Program

Methodology

Direct and transformative GHG savings for the ecoTECHNOLOGY for Vehicles Program (ETVP) were based on estimates calculated from the previous pilot Advanced Technology Vehicle Program, which followed a similar program model on a smaller scale. Direct savings refers to reductions from incremental advanced technologies that are embedded in conventional vehicles in the Canadian market. Transformative savings refers to reductions from non-conventional advanced vehicles (e.g. hybrids, electric, etc.)

For direct GHG savings, it was assumed that 20% of sales of new vehicles with less than 6 litres/100 km fuel efficiency would be influenced by public outreach and education activities of ETVP.

Transformative emissions savings estimates were based on the forecast market shares of advanced technology vehicles over the relevant period. Advanced technology vehicles were defined as vehicles presenting an 11.5% improvement. In comparison, the average improvement of new vehicles was estimated at 7.5%. It was assumed that 20% of these advanced technology vehicle sales were attributable to the ETVP.

In both cases, vehicles were assumed to save 2 litres/100km and travel 23,500 km per year.

Uncertainty Analysis

Preliminary estimates were based on assumptions made about new vehicle sales, technology penetration and vehicle distance travelled forecasts. The economic downturn has impacted significantly on vehicle sales. In addition, fuel prices are also lower than expected, making advanced technologies less attractive due to a longer payback period. These factors will contribute to a lower market penetration of advanced technologies and reduce the overall impact of the program within the program timelines. Initial reductions estimates are expected to be achieved 2 to 3 years after the end of the program.

The low scenario assumes lower market penetration of advanced technologies, lower fuel saving applied to lower sales figures.

ecoENERGY for Fleets

Methodology

This program contains a number of elements whose impacts were calculated individually. The estimated energy savings were calculated based on the expected number of transportation professionals reached by the program, the changes in their behaviour resulting from the program, and the fuel saved because of these changes.

Government publications, accepted models, technical studies and past program files provided variables and the basis for the estimates of participation, rates of adoption of fuel-efficient practices, and the average impact of these practices.

Uncertainty Analysis

The Government of Canada has a number of programs to reduce GHG emissions from the freight transportation sector. Transport Canada's ecoFREIGHT program aims to reduce emissions from freight transportation through partnerships, promotion of technologies, and addressing regulatory barriers that limit uptake of emission-reducing technologies. Natural Resources Canada's ecoENERGY for Fleets program aims to reduce emissions from freight transportation through behavioural change as a result of training and awareness campaigns. These programs are designed to be complementary; however, there is a potential for overlap in the impacts of the programs. For example, if an emission-reducing technology reduces a truck's overall emissions by 4%, the total remaining emissions is 96%. Any further measures added can only impact the remaining 96%. The impact of the overlap is deemed to be very small because the impact of each individual measure is small. Nonetheless, in order to account for potential overlap between Transport Canada's programs and Natural Resources Canada's programs, expected reductions represent conservative estimates of program impacts.

Description of Methodology for Identifying Actual Reductions for 2008

Results are based on actual program participation.

ecoFREIGHT

Methodology

Preliminary estimates of GHG emission reductions are based on the data supplied by the project proponents in historical or previous program proposals, Contribution Agreements, progress and final reports.

The historical data was adapted to form the preliminary impact estimates for the current ecoFREIGHT programs by pro-rating the direct GHG impacts on the basis of the magnitude of the funding allocated to the new programs.

The ecoFreight direct impact was calculated from the forecasted number of projects and their GHG impacts. The ecoFreight indirect (i.e. transformative) impact was calculated by applying a factor of approximately 2 (2008: 1.75 to 2012: 2.4) to the direct impact of a particular year. The factors were obtained from the indirect calculation assumptions based on the simple payback period of the technologies. If the direct impact was estimated at 100 Kt in 2012, the indirect impact was estimated at

240 Kt for a total impact of 340 Kt in 2012. Where appropriate, reduction associated with the Memoranda of Understanding and with speed limiters activities were added to the estimates.

Uncertainty Analysis

The scenarios were developed by updating the preliminary estimates for direct impacts with information drawn from the actual projects now receiving funding under the program, rather than information from historical projects. The current technology projects will be completed progressively by 2010/11 under the program. A 0.4 Mt annual reduction was included in the reductions from the activities of the NHTSI, reflecting estimated impacts of the truck speed limiter regulations in Ontario and Quebec. (Note that there is no consensus among jurisdictions at this time to proceed with a national mandate on such regulations.)

The uptake of technology may differ due to increases in the costs of equipment and/or the ability/willingness of promoters to invest in such projects during the economic downturn.

In addition, fuel prices are also lower than expected, making energy-saving technologies less attractive due to longer payback period. These factors may reduce the overall market penetration of energy-reducing technologies and reduce the overall impact of the program. The key uncertainty addressed in the scenarios is linked with the transformative or indirect impacts.

The expected scenario is based only on the expected direct reductions of projects selected under ecoFREIGHT program funding Rounds 1 and 2, which are expected to contribute an estimated 57.3 Kt of GHG emission reductions in 2012 to the impact of ecoFREIGHT. It is also based on the introduction of speed limiters in 2 provinces. No replication, or indirect effect, is assumed by 2012. In the High scenario, indirect reductions are assumed to occur through replication of program projects in the freight industry. The ecoFREIGHT indirect (i.e. transformative) impact was calculated by applying a factor of approximately 2 (2009: 1.75 to 2012: 2.4) to the revised direct impact of a particular year as described in the methodology section.

Both scenarios also include targeted reductions (from 0.5 Mt in 2009 to 0.9 Mt in 2012) under the voluntary agreements.

The Marine Shore Power Program

Methodology

The information used to calculate GHG emission reductions for the Marine Shore Power Program comes from Transport Canada's *Feasibility Study to Determine Suitable Locations for Marine Shore Power Pilot Projects in Canada* (Final Report, July 2005). In this study, 15 sites were analyzed for which GHG estimates were calculated.

The approach averaged out the GHG savings of 11 of the 15 projects analyzed (excluding 4 projects considered to be too expensive to implement). The average net annual GHG savings used was 1.3 Kt per project

It was assumed that the funding received would allow for 4 projects to be implemented under the MSDP, each achieving an average net annual GHG reduction of 1.3 Kt for a total of 5.3 Kt in 2010. (Note that in reality it could be a mix of larger and smaller projects together.)

For the "transformative" impact of the program, it was assumed that two more projects would be implemented after 2010 (one in 2010 and one in 2012) as a result of the demonstrations, each also achieving a net annual GHG reduction of 1.3 Kt for a total of 2.6 Kt per year in 2012.

Uncertainty Analysis

The preliminary reductions initially estimated in 2006 assumed the implementation of a total of six projects of varying sizes. The number and/or size of projects were dependent on increases in the costs of equipment and/or the ability/willingness of promoters to invest in such project due to changes in economic activity.

The low scenario assumed that two projects would be funded under the Program with an estimated GHG reduction of 4.5 Kt in 2012: the Vancouver project with an estimated GHG emission annual reduction of 3.2 Kt starting in 2009, and one other project with an estimated GHG annual reduction of 1.3kt.

In 2010, a revised High scenario was estimated to account for the impact of the economic downturn on the program. Initially the High scenario assumed that a third project would be funded under the program. This project had to be removed from the emission estimates because the selected participant had to withdraw his proposal due to the economic recession.

Initially, the high scenario also assumed that two additional projects would be implemented as an indirect result of the demonstrations funded under the program. One project was assumed to start in 2010 and the other in 2012. In order to account for the economic slowdown, it is now assumed that both projects would take place in 2012. This necessarily reduces the GHG emission reductions. In summary, the revised High scenario now includes four projects with an estimated GHG emission reduction of 7.1 Kt in 2012. It is assumed that two projects will be funded under the program with an estimated GHG reduction of 4.5 Kt per year (as per the above low scenario). In addition, two other projects would take place in 2012 with an estimated GHG reduction of 2.6 Kt in 2012.

Promoting Sustainable Urban Transit

Methodology

The estimated emissions reductions for the 2010 Plan use the same methodology as the one used to calculate the estimated emissions reductions for the 2008 and 2009 Plans.

The calculation used information on public transit trips (ridership) and GHG emissions factors from the Climate Change Transportation Table. A constant 3.4% annual growth (average of the last four years) in ridership was used to project baseline levels of ridership over the 2009-2012 period. Based on a calculation that the tax credit would result in an effective fare reduction of 9.0%, and using a short-term own-price elasticity for the overall market of 2.5%, which is based on a study by Litman for the Victoria Transport Policy Institute, new (incremental) trips resulting from the tax credit were calculated. These new trips were adjusted to estimate reduced vehicle trips based on information on vehicle occupancy from Transport Canada, and appropriate emissions factors were applied to these figures to produce the emission reduction estimates for each year.

Uncertainty Analysis

There are many factors at play which make it virtually impossible to assign GHG emission reductions to this measure with any certitude. Vehicle operating cost increases (fuel price, parking costs, etc.), and transit supply or service improvements are just two factors that can influence ridership. Moreover, improvements to vehicle fuel economy and the increased penetration of lower-emitting fuels would work to lower the overall emissions reduction potential. Therefore, the estimated reductions are likely representative of the upper bound of potential reductions for this measure.

Description of Methodology for Identifying Actual Reductions for 2008

The actual reductions are estimated by multiplying the average GHG savings from switching to transit (i.e., 1.05 kg) by the number of claims submitted for Public Transit Tax Credit. The estimated reductions accruing directly to PTTC claims are 0.0015 megatonnes (Mt).

Provincial Greenhouse Gas Mitigation Programs

Methodology

All provincial actions, such as Ontario's phase-out of coal-fired power plants, provincial renewable promotion programs, Quebec's carbon levy and the British Columbia carbon tax, as well as Alberta's *Climate Change Emissions Management Amendment Act* and Nova Scotia's emissions cap on electricity generation, are included in the business-as-usual base case. Therefore, the impact of these programs is reflected in the total emissions estimated for both the core and alternative scenarios we have examined.

The information used to calculate GHG emission reductions from the various provincial policies come from provincial legislation and budget documents. For example, the modeling reflects the specific tax rates, emission caps or intensity targets and penalties for the following major provincial initiatives, among others.

- British Columbia's carbon tax was introduced in the 2008 budget, with a July 1, 2008 implementation date. The tax was initially set at $10 per tonne of carbon dioxide emissions, and is scheduled to rise by $5 per tonne in each of the next four years, reaching $30 per tonne of CO_2 in 2012.[17]
- Alberta's emissions-trading system for large industrial emitters has been in place since July 2007. The system is based on emissions intensity and firms can meet 100 per cent of their obligation by paying $15 per tonne into an Emissions Management Fund, which will be used to "drive innovation, test and implement new technologies, and achieve the goal of greening energy production.[18]
- In October 2007, Quebec implemented a carbon tax based on the following rates: 0.8 cents per litre on gasoline; 0.9 cents on diesel fuel; 0.96 cents on light heating oil; 1.0 cent on heavy heating oil; 1.3 cents on coke used in steel making; 0.5 cents on propane; and $8 per tonne on coal. The province expects to raise about $200 million per year to finance the province's green plan.[19]
- Nova Scotia's regulation, which came into force in August 2009, caps greenhouse-gas emissions at 19.22 million tonnes (cumulative 2010 and 2011), at 18.5 million tonnes (cumulative 2012 and 2013), at 26.32 million tonnes (cumulative 2014 through to 2015), at 24.06 million tonnes (cumulative 2017 through to 2019) and at 7.5 million tonnes in 2020.[20]

Canada's Greenhouse Gas Emissions Levels for 2008-2012

The Government of Canada is applying Environment Canada's integrated Energy, Emissions and Economy Model for Canada (E3MC) to estimate the reduction for the overall integrated package of measures. The modeled runs incorporate individual parameters for each of the initiatives reported here, as provided by lead departments, and aggregate the results to report on Canada's net emission reductions and total remaining emission levels for 2008-2012. The use of the model responds to the

[17] B.C. Ministry of Finance (2008): www.leg.bc.ca/38th4th/3rd_read/gov37-3.htm and www.sbr.gov.bc.ca/documents_library/notices/BC_Carbon_Tax_Update.pdf.
[18] Government of Alberta (2008). http://environment.alberta.ca/02486.html.
[19] www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=5&file=2006C46A.PDF
[20] www.gov.ns.ca/just/regulations/regs/envgreenhouse.htm

NRTEE's suggested methodological improvement for an "integrative accounting of the emission reduction estimates."

2008 Emissions

The *Act* requires that the expected emissions reductions be compared to the levels in the most recently available emissions inventory for Canada. This stipulation implies that reductions must be "additional to any that would otherwise occur." As the 2008 inventory includes the impact of actions from all levels of government, it is necessary to specify the hypothetical, unobservable baseline level of emissions (i.e., the baseline without the actions from governments).

Following the methodological approach used in the two previous reports, a no-programs baseline was developed for 2008. The 2008 no-programs emission level was developed in the following manner:

1. Starting with the emissions baseline developed for the 2009 KPIA report, adjustments were made to critical assumptions which are not influenced by the measures previously outlined in this report. These adjustments include:
    - Gross Output Product: Use of actual 2008 provincial and national gross domestic product rather than the "estimated level."
    - Output: Use of actual 2008 output levels rather than the "estimated level". Output, whether the dollar value of output in "real or constant dollars" or physical output (e.g., barrels of oil, cubic feet of natural gas, megawatt hours of electricity, tonnes of cement, etc), is a key driver for projecting emissions.
    - Electricity Generating Units: Use of actual performance for 2008 rather than the estimated performance based on 2007 operating factors. For example, hydro availability is a critical factor in how much electricity can be generated from this source. Generating more hydroelectricity means less reliance a more emission intensive sources such as coal-fired, natural gas-fired or oil-fired.
    - Energy Prices: Use of actual 2008 provincial and national gross domestic product rather than the "estimated level". Price is an important driver in that it influences the level of "autonomous" efficiency improvements or emission reductions. That is, efficiency improvements or emission reduced that are induced by changing energy prices.
2. A new adjusted baseline reflecting 2008 actual parameters was constructed. This adjusted baseline generates an estimate of fuel use and emissions based on actual economic drivers and energy prices.[21]

Applying these adjustments to the emissions baseline developed for the 2009 Plan generates a "counter-factual" baseline which can then be compared to the "actual" 2008 emissions level reported in the National Inventory Report. Using the adjusted Reference baseline excluding federal Government measures facilitates the assessment of the effectiveness of government programs. That is, the reduction potential of federal government programs is the difference between actual reported emissions and the baseline excluding the GHG reduction programs.

2009-2012 Emissions

To capture the effects of the Government's climate change programs, the assumptions used for the individual measures were built into the closely replicated E3MC model. In the model, consumers of energy respond to the program parameters by making decisions regarding investments using Qualitative Choice Theory.[22] These decisions are based on the price of fuel combined with the perceived trade-off between energy savings through improved efficiency and capital and operating costs. For example, a program such as the ecoENERGY Retrofit Initiative provides financial support to

[21] This analysis excludes the impacts of policies and initiatives on actual 2008 data for GDP and energy prices.
[22] Qualitative Choice Theory is based on the work of the Nobel Laureate, Daniel McFadden. Using Dr. McFadden's theory, several other leading economists such as Kenneth Train have applied this theory to estimating demand in key energy using sectors of the economy such as transportation and the built environment.

reduce the cost of implementing an energy efficiency project, encouraging investment by improving the trade-off between efficiency and investment costs.

The 2009-2012 emission levels for Canada were generated by combining the individual emissions reductions measures in E3MC. This ensured that measures were assessed in an integrated manner, thereby accounting for positive and negative interactions between measures and regulations.

Uncertainty Analysis

An alternative scenario has been constructed as a component of Environment Canada's sensitivity analysis. In this alternative scenario, the economy is projected to grow at 1.7% per year over the 2008 to 2012 period (as opposed to 1.6% under the reference case). Over the same period, the world oil prices are assumed to average about $98 per barrel (in US$2008) instead of $76 per barrel under the reference case.

Under the alternative scenario, it is also assumed that the emissions reduction potential of the measures presented in this report are not fully achieved. The modeling assumes that these measures achieve a level of expected reductions consistent with the "low" expected reductions, where indicated in this report.

Environment Canada's E3MC Model

Environment Canada's E3MC has two components: Energy 2020, which incorporates Canada's energy supply and demand structure, and TIM, Informetrica's macroeconomic model of the Canadian economy.

Energy 2020 is an integrated multi-region, multi-sector North American model that simulates the supply, price and demand for all fuels. The model can determine energy output and prices for each sector, both in regulated and unregulated markets. It simulates how factors like energy prices and government policies affect the choices that consumers and businesses make in the purchase and use of energy. The model's outputs, which include changes in energy use, energy prices, greenhouse gas emissions, investment costs and possible cost savings from policies, are used to identify the direct effects stemming from greenhouse gas reduction measures. The resulting savings and investments from Energy 2020 are then used as inputs into TIM.

TIM is used to examine consumption, investment, production, and trade decisions in the whole economy. It captures not only the interaction among industries, but also the implications for changes in producer prices, relative final prices and income. It also factors in government fiscal balances, monetary flows, interest and exchange rates.

More specifically, TIM incorporates 133 industries at a provincial and territorial level. It also has an international component to account for exports and imports, covering approximately 100 commodities. The model projects the direct impacts on the economy's final demand, output, employment, price formation and sectoral income that result from various policy choices. These, in turn, permit an estimation of the effect of climate change policy and related impacts on the national economy.

Treatment of Interaction Effects

The analytical approach permitted by E3MC addresses several key modeling challenges, namely additionality, free ridership, rebound effects, and policy-interaction effects.

The additionality issue refers to the question of what would have happened without the initiative in question. Problems of additionality arise when the stated emissions reductions do not reflect the difference in emissions between equivalent scenarios with and without the initiative in question. This will be the case if stated emissions reductions from an initiative have already been included in the reference case – emissions reductions will effectively be double-counted in the absence of appropriate

adjustments. In the E3MC model, additionality is controlled for by the fact that model structure is based on incremental or marginal decision making. The E3MC model assumes a specific energy efficiency or emission intensity profile at the sector and end-use point (e.g., space heating, lighting, auxiliary power, etc). Under the E3MC modeling philosophy, if the initiative in question was to increase the efficiency of a furnace, only the efficiency of a new furnace would be changed. The efficiency of older furnaces would not change unless those furnaces are retired and replaced with higher efficiency ones. As such, any change in the model is incremental to what is reflected in the business-as-usual assumptions.

A related problem, free ridership, arises when stated reductions include the results of behaviour that would happen regardless of the policy. This can occur when subsidies are paid to all purchasers of an item (e.g., a high efficiency furnace), regardless of whether they purchased the item because of the subsidy. Those who would have purchased the product regardless are termed free-riders. In our model, the behaviour of free-riders has already been accounted for in the reference case. Their emissions are not counted, therefore, toward the impact of the policy. Instead, it is only the incremental take-up of the emissions-reducing technology that is counted.

The rebound effect describes the increased use of a more efficient product resulting from the implied decrease in the price of its use. For example, a more efficient car is cheaper to drive and so people may drive more. Emissions reductions will generally be overestimated by between 5% and 20%, if estimates do not account for increased consumption due to the rebound effect. Within the model, there are mechanisms for fuel choice, process efficiency, device efficiency, short-term budget constraints and cogeneration, which all react to changes in energy and emissions costs in different time frames.[23] All these structures work to simulate the rebound effect – in the example above, the impact of extra kilometres that may be driven as a result of improved fuel efficiency are automatically netted out of the associated emissions reduction estimates. Finally, emissions-reduction policies such as the ones defined in the Government's plan interact with each other, with a resulting impact on their overall effectiveness. A policy package containing more than one measure or policy would ideally take into account this impact to understand the true contribution the policy package is making (in this case to emission reductions). This impact is described through what are known as policy interaction effects.

As E3MC focuses on the marginal decisions being made by consumers, industry and energy producers, the issue of additionality, free-ridership, rebound effects, and policy-interaction effects are addressed in both the business-as-usual case and when analyzing policies and measures.

E3MC is a comprehensive and integrated model focusing on the interactions between sectors and policies. In the demand sectors, the fuel choice, process efficiency, device efficiency, and level of self-generation are all integrally combined in a consistent manner. The model has detailed equations to ensure that all the interactions between these structures are simulated with no loss of energy or efficiency. For example, the electric generation sector responds to the demand for electricity from the energy demand sectors, so any policy to reduce electricity demand in the consumer sectors will impact the electric generation sector. The model accounts for the emissions in the electric generation sector as well as the consumer demand sectors. As the electric sector reduces its emissions intensity, policies designed to reduce electric demand in the consumer sectors will cause less of an emissions reduction. The natural gas and oil supply sectors similarly respond to the demands from the consumer sectors, including the demands for refined petroleum products for transportation. As well, the export by supply sectors of their products is also simulated.

Taken as a whole, the E3MC model provides a detailed representation of technologies that produce goods and services throughout the economy and can realistically simulate capital stock turnover and choices among technologies. It also includes a representation of equilibrium feedbacks, such that

[23] A shift in energy prices will cause cogeneration to shift in the short to medium term, device efficiency to adjust over the short to mid-term, process efficiency to adjust in the mid term, and fuel choice to react in the mid- to long-term. The actual adjustment times depend on the particular sector.

supply and demand for goods and services adjust to reflect policy. Given its comprehensiveness, E3MC covers all the greenhouse gas emissions sources, including those unrelated to energy use.

Simulation of capital stock turnover

As a technology vintage model, E3MC tracks the evolution of capital stocks over time through retirements, retrofits, and new purchases, in which consumers and businesses make sequential acquisitions with limited foresight about the future. This is particularly important for understanding the implications of alternative time paths for emissions reductions. The model calculates energy costs (and emissions) for each energy service in the economy, such as heated commercial floor space or person-kilometre traveled. In each time period, capital stocks are retired according to an age-dependent function (although the retrofitting of un-retired stocks is possible, if warranted by changing economic conditions). Demand for new stocks grows or declines depending on the initial exogenous forecast of economic output (i.e., a forecast that is external to the model and not explained by it) and the subsequent interplay of energy supply-demand with the macroeconomic module. A model simulation iterates between energy supply-demand and the macroeconomic module until there is a convergence. The global convergence criterion is set at 0.1% between iterations. This convergence procedure is repeated for each year over the simulation period.[24] E3MC simulates the competition of technologies at each energy service node in the economy based on a comparison of their cost and some technology-specific controls, such as a maximum market share limit in cases where a technology is constrained by physical, technical or regulatory means from capturing all of a market. The technology choice simulation reflects the financial costs as well as the consumer and business preferences, revealed by real-world technology acquisition behaviour.

Model Challenges and Limitations

While E3MC is a very sophisticated analytical tool, no model can fully capture the complicated interactions associated with given policy measures between and within markets or between firms and consumers. Unlike computable general equilibrium models, however, the E3MC model does not fully equilibrate government budgets and the markets for employment and investment. That is, the modeling results reflect rigidities such as unemployment and government surpluses/deficits. Furthermore, the model, as used by Environment Canada, does not generate changes in nominal interest rates and exchange rates, as would occur under a monetary policy response to a major economic event.

[24] The energy technology simulation component of the E3MC model (i.e., Energy 2020) does not have an explicit test for convergence because of the algorithm used in the model. The macroeconomic component of the E3MC model (i.e. The Informetrica Model or TIM) is used to test for convergence between the two models because, logically, if one model continues to send the identical information to the other model, then necessarily the other model should find the exact same solution as before. As the initial testing showed that after about 3 iterations most of the variables in TIM were very close to convergence, the maximum iteration for convergence is set to 5.

Annex 3

Sector and Labour Impact Projections under the Government's Response to the KPIA

Just Transition for Workers

Pursuant to the requirements of paragraph 5 (1) (a) (iii.1) of the *Act* regarding measures respecting a just transition for workers affected by greenhouse gas emission reductions, the Government considered the requirement and determined that the implementation of regulatory or other measures proposed in this report will not require significant worker adjustment in regulated industries.

Under a modeled scenario where all the federal mitigation measures included in this plan are implemented employment levels are projected to increase from 17.1 million in 2008 to 17.4 million in 2012. Accounting for the job losses incurred during the recession, this represents approximately 118,000 additional potential jobs per year during the Kyoto Protocol period. Comparing employment levels under the *Kyoto Protocol Implementation Act* to a Reference scenario – a scenario that does not include the measures included in this plan and only includes those federal and provincial measures announced as of January 1, 2006 – the analysis suggests no discernable or statistically significant impact on employment. By 2012, with all of the federal measures included in this plan implemented employment is expected to be 17.4 million compared to 17.39 million in the reference case.[25] Based on these results, the Government concluded that there will not be a significant impact on employment. Therefore, there will be no need to plan for measures aimed at workers transitions.

Equitable Distribution among Sectors

Paragraph 5 (1) (d) of the *Act* requires the Government to ensure "an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions". The integrated modeling suggests that by 2012, greenhouse gas emissions could be some 10 Mt lower than those projected in the business-as-usual case. The model further suggests that the majority of these reductions would occur in the transportation sector (i.e., 5.2 Mt or about 52% of the reductions are expected to occur in 2012) and in the electricity sector (i.e., 3.6 Mt or about 36% of the reductions are expected to occur in 2012). The buildings sector (residential and commercial sectors) is also expected to make an important contribution (i.e., 1.3 Mt or some 13%). Based on the targeted incidence of the suite of announced federal mitigation measures, there will not be any notable inequities among sectors.

Table 1: Projected Sectoral Emission Reductions Under the Government's Response to KPIA

	2009	2010	2011	2012
Residential	0.1	0.2	0.3	0.3
Commercial	0.3	0.6	0.7	1.0
Transportation	1.3	1.6	4.0	5.1
Industrial (Excluding Electricity)	0.1	0.1	0.1	0.0
Electricity Generation	1.2	2.6	3.2	3.6
Agriculture, Wastes & Others	0.0	0.0	0.0	0.0
Total	3.0	5.1	8.3	10.0

[25] These represent changes in a specific year. Macro-economic changes of this order of magnitude are negligible, and indicate no discernable or statistically significant impact on employment.

It should be noted that the emissions reductions reported in Table 1 represent where the emission reduction occurs; not where the policies were targeted. This is an important distinction for measures which affect electricity demand, and hence, emissions from the Electric Power Sector.

Measures aimed at reducing electricity demand are typically implemented by residential households or by commercial/institutional users. As such, the reduction in electricity use occurs in the residential or commercial sector. Given the treatment of electricity-related emissions, the contribution of the residential and commercial sector is somewhat underestimated, while the contribution of the Electric Power Sector (and Industrial: Large Final Emitter category in general) would be overestimated.

In summary, the modeling suggests that impacts across all sectors will not result in any notable inequities among sectors.

www.ec.gc.ca

Additional information can be obtained at:

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